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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

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VOL. XLII., No. 24. FRIDAY, JUNE 14, 1907.

The Pittsburg, Western and Southwestern Railway Clubs have all suggested an increase in the price of labor and materials as laid down in Rules of Interchange. Unlike the suggestions of previous years the increase proposed is general, covering broadly car bodies, miscellaneous castings, wheels, axles, lumber, couplers, journal bearings, etc., and labor, rather than specific charges for parts or repairs which are covered in the detailed list of prices. It is generally recognized that for the last two or three years many of the prices allowed were below the market value of equipment and material and the proposed changes are good evidence of the increase in cost of supplies throughout the country. The Pittsburg Railway Club suggests for example an increase from 1¾ cents per pound to 2 cents for iron castings, 3¼ cents to 3½ cents for lumber, increases from $0.50 to $1.00 in the price of couplers, and most important of all an increase of 25 per cent. in the price for labor from 20 cents an hour to 25 cents. The M. C. B. Association can hardly fail to recognize the justice of their unanimous demands and revise the existing prices to an equitable basis.

Our attention has been called to an error in the table of the "Comparative Summary of Freight Cars in Service in the Railroads of the United States" printed in *Railroad Gazette*, May 17, page 683, which, while not affecting the value of the table as a whole or the accuracy of the individual figures for any one road, is misleading. The summarized figures under each group and for all roads are mean values of the individual figures in the columns above and are not true or weighted averages for the entire group. In using the table, therefore, care should be taken not to make comparisons of individual figures with the mean values. Comparisons between individual figures will, of course, be correct. It is the intention to revise the table and bring it up to date each year and next year the true averages will be computed for 1906 as well as 1907.

Interstate Commerce Commission Rulings is the heading of a new department in the General News Section of the *Railroad Gazette* which appears for the first time this week. There are so many cases and complaints being decided by the Interstate Commerce Commission that there appears to be good reason for establishing a definite place in the paper where they may be found, both as a matter of convenience in current issues and in looking up cases which have been decided in the past. While this column will not necessarily contain every case decided by the Commission, it is intended to have it include all of any general importance, either because of the effect on particular rates or charges, or as indicating the general trend of the Commission's opinions. It will also be possible from this column to form an estimate of the work of the different commissioners. Many of the cases are now being heard before a single commissioner acting for the whole Commission and opinions are written by a single individual. The name of the commissioner who hands down an opinion will be included in the cases mentioned, so that it will be possible to form an estimate of the work and views of each member of the board.

The pooling of freight cars is now receiving the careful consideration of at least one railroad association. The Car Service Committee of the Association of Transportation & Car Accounting Officers in a recent circular makes a report on this question, prefacing its statements with the remark that it has not yet been able to arrive at final conclusions. It describes a general plan for a freight car pool. Pooling centers should be established in the different traffic zones, the country being divided as much as possible according to the various commodities handled, particularly those requiring special classes of cars. The reason for this is that as a large percentage of the traffic originating in a certain zone is finally disposed of within that zone, a mutual pool composed of the roads operating in this territory would be of much greater benefit than a general pool with uniform rules for every district. To provide, however, for the centralization necessary to a successful carrying out of the plan, there would be a chief commissioner at some central point with whom the district commissioners in charge of the pools in the different traffic zones would constantly keep in close touch. The chief commissioner would thus know the shortage or surplus in each district and could help one or another district as conditions required. For example, there should be a district pool in the eastern field with a district commissioner located at New York, Philadelphia, Buffalo or Pittsburg; another in the Southeast with a district commissioner at Atlanta, Nashville or some other available point; another at Chicago, another at Memphis, Little Rock, Fort Worth or Dallas, and perhaps another at Denver, Omaha or some other similar point in the West. Roads which interchange a certain class of equipment, box cars, for instance, would come together and organize the district pools by electing an executive committee, a committee of master car builders and a committee of auditors or car accountants from their number. The executive committee would determine the number of cars each road should sup-

ply to the pool, basing this number on the number of its cars ordinarily on the tracks of the other pool roads in joint traffic; this is in order to prevent a given road from putting more cars in the pool than its proper quota. The executive committee would also determine the rate to be paid to the pool for use of pool cars, raising or lowering the rate as conditions in their judgment justified, that is, it would be possible to have payments for cars vary according to the value of cars. The executive committee would have the power to restrict the loading or delivery of empty pool cars to any particular non-member road found guilty of misuse of equipment and to require a member road making such deliveries to a restricted road to pay additional per diem on cars detained on the tracks of the restricted road. The commissioner for the pool would be elected annually by the executive committee. It would be his duty to keep a complete record of the movement of pool cars and a historical record showing the dimensions, capacity and original value of cars, and to make regular reports at short intervals to each member road of the number of pool cars charged to, as compared with the number of pool cars owned by it. The commissioner would not be authorized to arbitrarily order cars from one road to another, but would notify all members of the total number of cars on each road as compared with the number to which the road is entitled. On these facts the executive committee would determine whether a change in per diem rates should be made in order to bring about a more even distribution of equipment. The commissioner would prepare a monthly statement of all pool cars on each member road and the number of days charged against each road, and would collect per diem for the use of cars while on non-member roads. He would report to the executive committee cases of misuse and diversion occurring on non-member roads from which the committee could form a judgment as to the necessity of restricting delivery of pool cars to such roads. Pool cars would be lettered, Pool "A," Pool "B," or Zone "A," Zone "B," or Interstate "A" or Interstate "B," as desired, with the initials of the owner placed on the car in an inconspicuous position. It is recommended that for the present no pools should be undertaken with more than $100,000 cars. A smaller number would be preferable.

COMPARATIVE COST OF REPAIRING STEEL AND WOODEN CARS ON THE HARRIMAN LINES.

The record of comparative cost of repairs to steel and wooden cars which is being kept on the Harriman Lines has been given twice previously in these columns (July 21, 1905, and June 8, 1906). This record was begun in September, 1904. It embraces all the cars of steel or part-steel construction on the one hand, as against an approximately equal number of wooden cars of about the same age and capacity, affording an equitable comparison. The record to February, 1907, inclusive, is given below, through the courtesy of Mr. Kruttschnitt, and represents a period of two years and a half. The statement gives the average number of cars of each class for the period, the total cost of repairs to same and the average cost per car per month:

Steel Cars.

Kind of car.	Average No. of cars.	Total cost of repairs.	Average cost, repairs, car pr mo.
Ballast	460	$71,291.81	$5.17
Box	2,304	108,323.29	1.57
Coal	1,594	165,959.57	3.47
Dump	300	39,322.92	4.37
Flat	2,289	72,024.30	1.05
Furniture	297	32,198.04	3.61
Gondola or ore	1,419	134,019.10	3.16
Oil	871	261,613.43	10.01
Stock	1,693	55,908.34	1.10
Total	11,227	$940,660.90	$2.79
Wooden Cars.			
Ballast	457	$65,560.89	$4.78
Box	6,247	735,405.53	3.92
Coal	127	14,329.81	3.76
Flat	512	15,699.75	1.02
Furniture	278	61,999.51	7.44
Oil	247	96,910.90	13 05
Stock	2,700	291,940.19	3.61
Total	10,568	$1,281,846.58	$4.04

The average total number of cars of both kinds show decreases from last year's statement. This is particularly the case with the steel cars, there being a difference of 477. This, however, is not due to destruction of equipment, but to the fact that the previous statement was incorrect to the extent of having had included in it some new cars bought some time after the record was begun, the error not having been discovered until after the publication of the statement. The wooden equipment shows a decrease of 73 cars from the previous statement.

It will be observed that the oil cars show an unusually high figure. This is due to the fact that all these cars were new equipment to begin with and when they were first received it was deemed advisable to make a number of alterations, which were charged to repair account, producing the abnormal figure given. Current repairs on these cars are not expected to average any higher than other equipment. The gradual increase in the figure for average cost of repairs per car per month over the period covered by the record was commented on in connection with the previous statement; the increases during the year since the publication of the first statement being 22 and 17 per cent. respectively for the steel and wood equipment. A further increase is shown in the present statement of from $2.42 to $2.79 for the steel and $3.74 to $4.04 for the wooden cars, the percentages being respectively 15 and 8 per cent. When the record is a little older it will be interesting to show this condition graphically.

STEEL PASSENGER CARS

The Pennsylvania's recent order for 200 steel passenger cars of various types, which are illustrated elsewhere in this issue, marks the beginning of a period of standardization in the evolution of passenger car construction for regular road service from wood to steel. The New York Subway, the Philadelphia Rapid Transit Company, the Long Island, the New York Central and the West Jersey & Sea Shore have a large number of steel motor cars in use. The Harriman lines have built a few sample postal cars; the Pressed Steel Car Company, the Pullman Company, the American Car & Foundry Company and the Standard Steel Car Company have each built a few experimental cars of various types, but no railroad or contract builder up to this time has built a sufficient number of road-service cars to term the design standard. There is little likelihcod that in the future the Pennsylvania will depart widely from the designs now proposed. They are the result of nearly four years of experiment and analysis by the largest and best equipped mechanical department of any railroad in the United States. The fact that 200 cars have been ordered is sufficient proof that the railroad company is satisfied with its careful and painstaking work.

In steel passenger-car design there is a temptation to substitute rather than originate, but, on the other hand, there is great opportunity for employing new and original shapes and types of construction to excellent advantage. Nearly every designer has departed in some details from the old wooden construction which, after a period of more than 25 years, has become practically standard throughout the United States. The Harriman lines have abandoned the upper-deck and have gone back to the turtle back or arched roof of 30 years ago because it simplifies and cheapens the roof framing. The Pennsylvania has abandoned bolsters and substituted a method of symmetrically loading the center sills to give uniform deflection. The Hudson Companies have developed an economical truss side-frame which permits the use of side doors without using abnormally heavy center sills to carry the vertical load. Similar departures from wooden construction could be noted in almost every car which has so far been built. It is not alone in these essential elements, however, that the ingenuity of the individual designers is apparent. No two designs employ the same intricate construction in the window and door posts, in the platform, framing or in the application of sheathing and roofs. The ingenuity of the designers of these cars appears to be limited only by the scarcity of suitable commercial shapes in structural steel. Some have even gone so far as to have special shapes rolled, notably the special bulb angles used as belt rails under the windows of the Subway and Long Island cars. Pressed steel has been employed in many places where rolled shapes apparently did not satisfy the ideas of the designer.

All these variations in detail go far toward increasing the expense of manufacture of steel cars and, for the time being at least, almost limit their adoption as standard equipment to roads like the Pennsylvania, which can afford to order them in large numbers. The wood passenger-car builders have long since standardized nearly every detail of such cars and they are built, so to speak, by the foot. It is a fact that one large building company lays out all the timbers for the body and underframing of its cars with notched sticks and templates. So uniform is the output that it is able to make up ahead a large stock of finished parts and cars can be turned out at the minimum expenditure of time and money. The same thing is true to a great extent in freight-car construction, although the types and individual designs sometimes vary considerably. This similarity of output is not confined to any one builder, but the output of all the builders is substantially standard. In passenger-car construction, the framing perfected after many years by the Pullman

Company has been found to be the most satisfactory and is used almost exclusively.

If steel passenger cars are to come into general use, the same conditions of manufacture must soon begin to prevail, otherwise the output of the car building plants will be greatly reduced and the cost to the railroads increased. We will not attempt to say how this should be brought about. It is hardly within the province of the Master Car Builders' Association to arbitrarily adopt specific details of construction either as standards of the association or as recommended practice, but the Association could do much good through committees in collecting and analyzing the different designs proposed and encouraging the closest co-operation on the part of the railroads and the contract builders in preparing and adopting designs which, in the future, might be capable of being more or less closely standardized. Encouragement should be given to individual effort, but such effort should be guided toward one objective point.

CAST IRON CAR WHEELS.

Last Year the Master Car Builders' Association recommended an increase of ⅛ in. in the thickness of the flange on cast iron wheels, believing that the additional metal thus provided at the weakest point in the wheel would go far toward reducing the large number of flange breakages under high capacity cars. This recommendation was acted on by letter ballot and was not formally authorized until September. The time, therefore, has been too short to definitely determine the beneficial effects of the change. There is some difference of opinion among wheel makers as to the effect on the chill in the throat, some claiming that the increased thickness would reduce the chill and decrease the life of the wheel. Long continued service only will determine this question.

While such modifications in the form of the wheel will undoubtedly be of some benefit, the real truth in the matter has been for years and still is openly disregarded and put to one side while minor technical points are discussed with great seriousness and gravity. The vital trouble is that the prices paid for cast iron wheels do not admit of the use of a proper quality of metal or a proper order of practice in the manufacture of such wheels. For years, experienced wheelmakers have tried to emphasize this fact and for years the railroads have generally ignored it. Specifications and tests have been made more rigid and guarantees have been extended to cover nearly all the causes for which wheels are removed regardless of whether the defect was attributable to conditions of manufacture or not. Some roads have agreed to discontinue claims made on account of worn flanges when sufficient chill is found and on account of shelling out, due to severe applications of brakes, and a few other roads have consented to reduce the number of years for which guarantees are required, but while there is some small encouragement for the wheelmaker in this, the situation, as regards the railroads in general, is growing steadily worse from month to month. There are about 20,000 wheels made every day in the United States to go under new cars and for replacements, and a large proportion of these wheels are made by manufacturers who turn them out in connection with the manufacture of cars, operating a wheel foundry as they would any other department of their business. They are content to accept orders at competitive prices and turn out wheels of any quality that will admit of a margin of profit. It is perhaps not too much to say that 20 per cent. of the wheels made every day are totally unfit for service under heavy equipment. One car-wheel maker who has always maintained a reputation for turning out only the best quality wheels, during the year just passed, refused orders for nearly 200,000 wheels which were to be used under 50-ton cars, for the reason that the prices offered were totally inadequate to provide wheels of even ordinary quality, yet these orders were filled at the prices offered by other makers and the wheels are in service under cars.

The car-wheel situation is not exactly comparable with the steel-rail situation. The railroads have every reason to demand better rails for the same price, because they have only to cite such a case as the price of $18 a ton paid by the Japanese Government for steel rails for export and made to rigid specifications, as against the price of $28 a ton which the rail pool demands for rails rolled to the so-called commercial specification. The responsibility for defective rails lies largely with the rail maker, but the responsibility for defective wheels cannot be laid directly at the door of the wheelmaker. The railroads demand that the wheelmakers turn out wheels which will stand double the load imposed five or ten years ago under guarantees for as many years' service as was required for wheels used under the much lighter equipment and to furnish these wheels at prices lower than they pay for the commonest kind of iron castings. The Master Car Builders' Association allows 1¾ cents per pound for rough iron castings, but it allows only $8.50 for a cast-iron wheel weighing 700 lbs., or at the rate of less than 1¼ cents per lb. At such a price the wheel makers, in order to realize any profit at all, must resort to the most inexpensive and inefficient foundry practice possible and can use only the cheapest kind of scrap and gray forge iron. At the present prices of labor and melting stock and under the rigid guarantee required, it is impossible for wheel makers to turn out anything but scrap at the prices offered.

If the sole object of the present practice is to maintain a contest between the buyer and the seller as to which can get the best of the other regardless of results, the only remedy is to bring home the responsibility for the results to those who carry it on. The successful purchasing agent buys at the lowest possible price and he is concerned only with the price. If he is not advised by the officers in other departments that the material which he furnishes on requisition is not satisfactory and is dangerous to use then his responsibility ceases. Why should the officers in the car building and motive power departments be afraid to meet the issue fairly and squarely; why should they hesitate to say to the purchasing agent that they will not take the responsibility of placing the wheels he furnishes under cars? They know good wheels from bad wheels —at least they should know them if they are competent—and it is their duty to themselves and to the railroad they serve to prevent if possible the use of any material, whether it be boiler plate or axles or car wheels which they know to be unsafe. The situation is complicated, of course, by the fact that no one railroad can afford to take such a stand without the co-operation of all the other railroads, because the wheels bought by one railroad run over the lines of other roads. If a road buys wheels of good quality they may be replaced by wheels of poor quality as soon as the car leaves the home road. The necessity, therefore, is for concerted action and recognition by the most influential body of American railroad officers of the fact that their duty is, not to avoid in every possible way reference to prices and other commercial considerations, but to make their recommendations as to what they want and must have regardless of prices. If they make their requirements severe enough to be met only by wheels of first-class quality and insist firmly enough on having only such wheels furnished them, the situation will begin to clear up at once and the responsibility will be put where it belongs.

ONE CAUSE OF DERAILMENTS.

The proper location of the side bearings—that is, the distance from center to center—together with the amount of vertical clearance between them, undoubtedly has much to do with the safe movement of cars or locomotive tenders of different types and dimensions when moving over track of varying physical conditions, and particularly so when rounding curves at different rates of speed. Some inquiries recently made of leading mechanical department officers show that the distance between side bearings of the cars of these companies varies from 42½ in. to 65 in., while on some locomotive tenders the distance is as great as 88 in. The amount of clearance between side bearings varies from ⅛ in. to about ½ in. on each side. From 12 important railroads and one private car line the following dimensions are reported as the practice followed on their respective lines: 42½ in., 48 in., 51 in., 56 in., 57 in., 59 in., 60 in., 62 in., 63 in. and 65 in., and for tenders, 88 in. On some roads the practice or standard is the same for all kinds of cars and locomotive tenders, no distinction being made between gondola or hopper cars used in ore or coal traffic, and furniture and refrigerator cars, or tenders.

The views held by the ablest mechanical officers in the country are in many cases directly opposite, and while it would appear that there are more cars at present with the side bearings 60 in. between centers than of any other dimension, yet there are many only 48 in. between centers, and the officers who have adopted this small dimension as the best practice to follow support their position with a record of extensive experiments with side bearings at different locations which seemed to justify their conclusions and practice.

Certain known conditions of track superstructure must exist, of course, in order to insure the safe movement of trains both on tangents and curves. Likewise the equipment must be designed and built with a view to its safe movement, it being quite as essential that the cars and locomotives should be free from defective design,

construction or physical condition as the superstructure which supports them. Of the numerous dimensions for locating side bearings observed by different roads, some certainly are not as well adapted to the safe movement of cars at different speeds as others, and it, therefore, appears to be a question that not only justifies, but seems to require, immediate attention; in fact, it seems of sufficient importance to warrant some process of analysis that involves determining by exhaustive experiments such a combination of dimensions, types, location, clearance, etc., as is best adapted to different types of cars and engine tenders at different rates of speed on a superstructure of known conditions. Derailments of refrigerator, carriage and furniture cars on curves, because of their high center of gravity under load, are good subjects on which to base investigation and inquiry and with which to conduct experiments in an effort to arrive at some uniformity of standard.

Recent articles in the technical journals have brought into prominence the fact that there are among engineering and maintenance of way officers distinct differences of opinion in reference to superelevation and other track conditions that exert more or less influence on the safe movement of trains. That track elevation on curves is based on correct principles no one with the slightest knowledge of the laws of moving bodies will question. There may be, and doubtless are, some differences of opinion as to just the desirable amount. Track that is designed for the safe movement of trains at a speed of 30 or 40 miles an hour around curves of 10 to 16 deg., has such elevation of the outer rail as is necessary to counteract the centrifugal force at that speed. An entirely different proposition is presented when these same trains traverse the curve at 8 or 10 miles an hour. The car which would safely and easily round the curve at the higher rate of speed would at the lower rate of speed, in the absence of centrifugal force, bear heavily on the inside side bearing and the rear wheel of the truck would hug closely the inside rail. The distance of the side bearing from the center plate is the measure of, or governs the proportion of, the total weight of the car resting upon the inside bearing under these conditions. The closer the bearings are located to the center plate, the greater this weight; the greater the distance, the less the weight. It is also true that the greater the amount of weight supported, the greater the friction or the resistance to the swiveling of the truck. If the sum of the forces opposing the swiveling of the truck exceeds the pressure of the flange on the leading outside wheel against the railhead, then the wheel climbs the rail and a derailment follows.

It is therefore evident that under fixed or known conditions of track and equipment, considering the distance between the side bearing and the center plate and the center plate and the outside leading wheel as lever arms, the matter is susceptible of mathematical demonstration, both as to the cause of the derailment and the proper remedy therefor. But operating conditions are so varied that any result thus obtained theoretically, based on a given set of conditions, would, of course, require modification to meet different conditions; therefore it would seem that the "happy medium" which would prove the best for all conditions could best be found through a series of practical experiments under proper engineering supervision. The subject is of sufficient importance to warrant the expenditure of considerable money to the end that the best known types of center plates and side bearings be determined, together with their proper location and the amount of clearance for different kinds and types of cars, locomotive tenders and trucks; special care being taken, for example, to differentiate between trucks with springs located centrally over the arch bars and those having short truck bolsters with springs located inside of the truck frames; also to observe the difference in the action of steel car frames as compared with wooden frames. The former, on account of their greater rigidity, do not yield to undulating track and curve elevations as do cars of wooden construction, and this may be a factor to be taken into consideration in an experimental study of the problem.

Interstate Commerce Commission reports show that during the past year 381 persons were killed and 4,362 injured by derailments in the United States, a total of 4,743 which met with accident from this one cause. In addition to these there are doubtless many hundreds of derailments which are never reported, such, for instance, as cars in freight trains getting off of the track and being derailed without serious delay or injury. All such derailments together with those which have had more serious consequences, evidence the need of some combined effective effort to minimize their number.

This is a problem which cannot be solved by any one person or any one department, but it is too important to be iguored as it evidently is now by many companies. It is worthy of careful study, theoretical and experimental, by a committee of competent men representing the mechanical, operating and maintenance of way departments, which should determine some standards for future guidance.

CONTRIBUTIONS

Thickness of the Steel Side Plates in the Union Pacific Steel Box Car.

Omaha, Neb., June 5, 1907.

To the Editor of the Railroad Gazette:

Referring to your editorial on the light-weight, all-steel box car in the *Railroad Gazette* of February 22d: Your observations on the thickness of the steel side plates are well made. The thickness of this siding is a very difficult dimension to determine; practical experience is absolutely necessary before definite conclusions can be obtained. However, the enormous strength in the sides of these cars, showing a deflection of only $^{3}/_{16}$ in. with 50 per cent. overload, is highly indicative that the No. 11 B. W. G. steel is of a desirable and practical thickness for siding, affording resistance to puncture from load shifting. In the end these steel plates, I believe, will figure about six to seven times the strength of an ordinary wooden car and the distribution of stresses in a unit steel-structure car is entirely different from that in a wooden car and the subject must be viewed from an entirely different outlook. For example, the corner post of a wooden car is extended into the sill and is further supported, somewhat, by the superstructure at the top, but the ease with which a large oak corner post is broken in everyday service shows the weakness of this form of wooden construction. Compare the corner of a wooden car with an angle-iron corner post of the steel car. This corner post is supported in its entire height, from top to bottom, by the steel car side to which it is riveted. The steel of this car siding is secured and riveted to all the other members of the car side, as well as to the side sill and other end of the car, and the full tensile strength of this material can be utilized in offering resistance to the knocking out or bending of this corner post.

A limited bulging of a steel box car end is to be expected. However, this bulging will not in any way interfere with the strength of the end and cannot be considered a detriment; the steel end being so much stronger than any wooden structure, it will take practical experience to show the necessity of a heavy grade of steel for this service. Certainly, it will be more expensive to replace a steel plate than it would a few end boards on a wooden car, but on account of the strength of the steel it will not be necessary to repair same with the frequency which is now experienced in wooden cars.

Observations of the remarkable success with which the $^{3}/_{16}$ in. steel plates have met in gondola and hopper-bottom car work, as compared with the ¼ in. and $^{5}/_{16}$ in. sheet, led the Union Pacific to try the No. 11 B. W. G. sheet in the all-steel box car, especially as the duty of the box cars is entirely different and not half so severe as that of the gondola or hopper cars. The handling of stresses in an all-steel box car is entirely different from that of a gondola car, and the side of an all-steel box car is a combination of trusses and plate girders with a special design of underframing. The duty on this box car steel side is nothing like the duty imposed on an ordinary gondola car side.

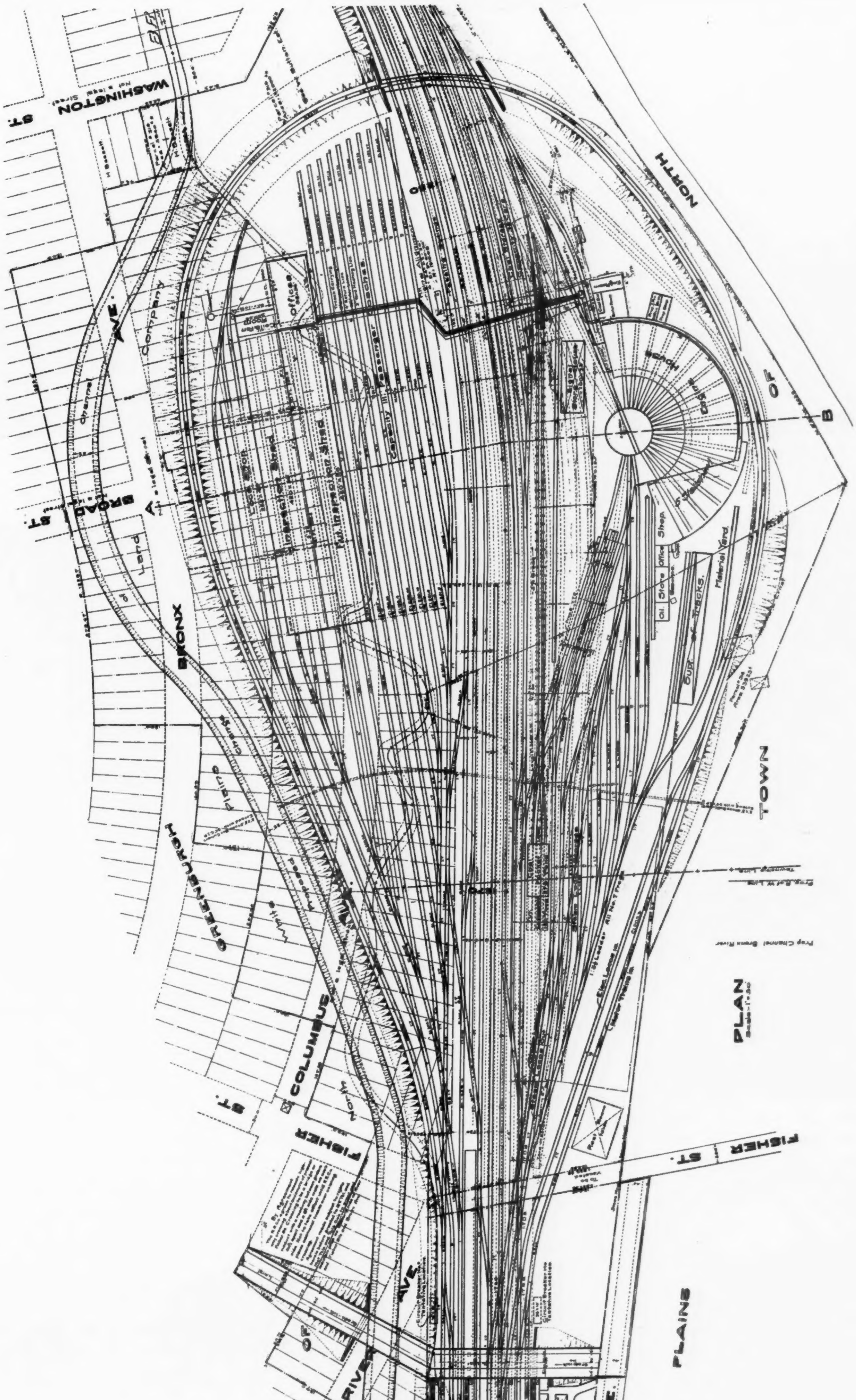
W. R. M'Keen, Jr.,
Supt. M. P. & M., Union Pacific.

Steam and Electric Locomotive Terminals of the New York Central at Croton and North White Plains.

The northern limits of the Electric Zone of the New York Central are to be at Croton on the Hudson River Division and at North White Plains on the Harlem Division. At these places the change from steam to electric locomotives will be made on all through trains incoming and outgoing and they will also be the terminals for the electric motor car local trains running to New York. Extensive engine terminal facilities are being built at both places to care for steam and electric equipment. The terminal of the Hudson Division is at South Croton or Harmon, as the new town is to be called, one mile south of Croton and 34 miles from the Grand Central station. North White Plains is 24 miles north of New York.

North White Plains Terminal.

The general layout of the engine terminal at North White Plains is shown in Fig. 1. The roundhouse, turntable and other buildings on the east side of the tracks are the old facilities used for steam service before the electrification was begun (North White Plains has been the northern terminal of the suburban service on the Harlem Division for a number of years). The new shop and inspection buildings for electric equipment are to the west of the railroad, which bisects the yard, and about 1,000 ft. north of the present North White Plains station. The only new building erected



Layout of Steam and Electric Locomotive Terminal at North White Plains; Harlem Division, New York Central.

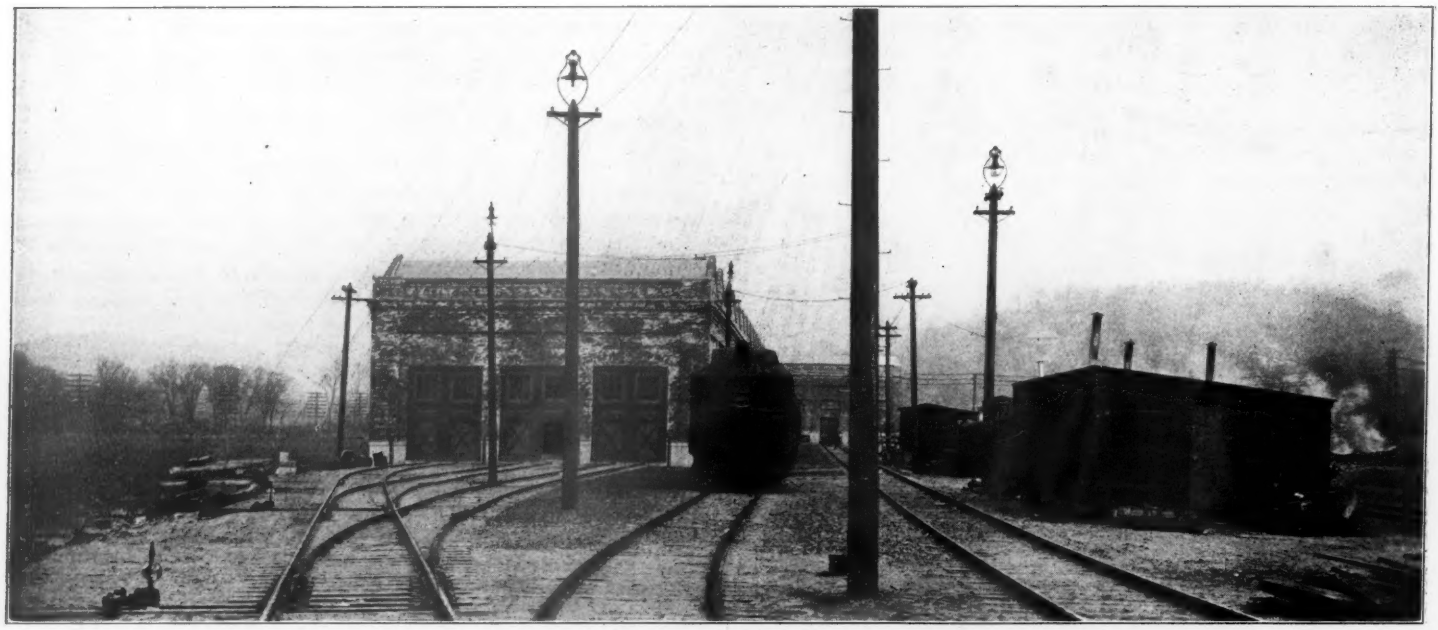


Fig. 2—North White Plains Shops, Looking North.

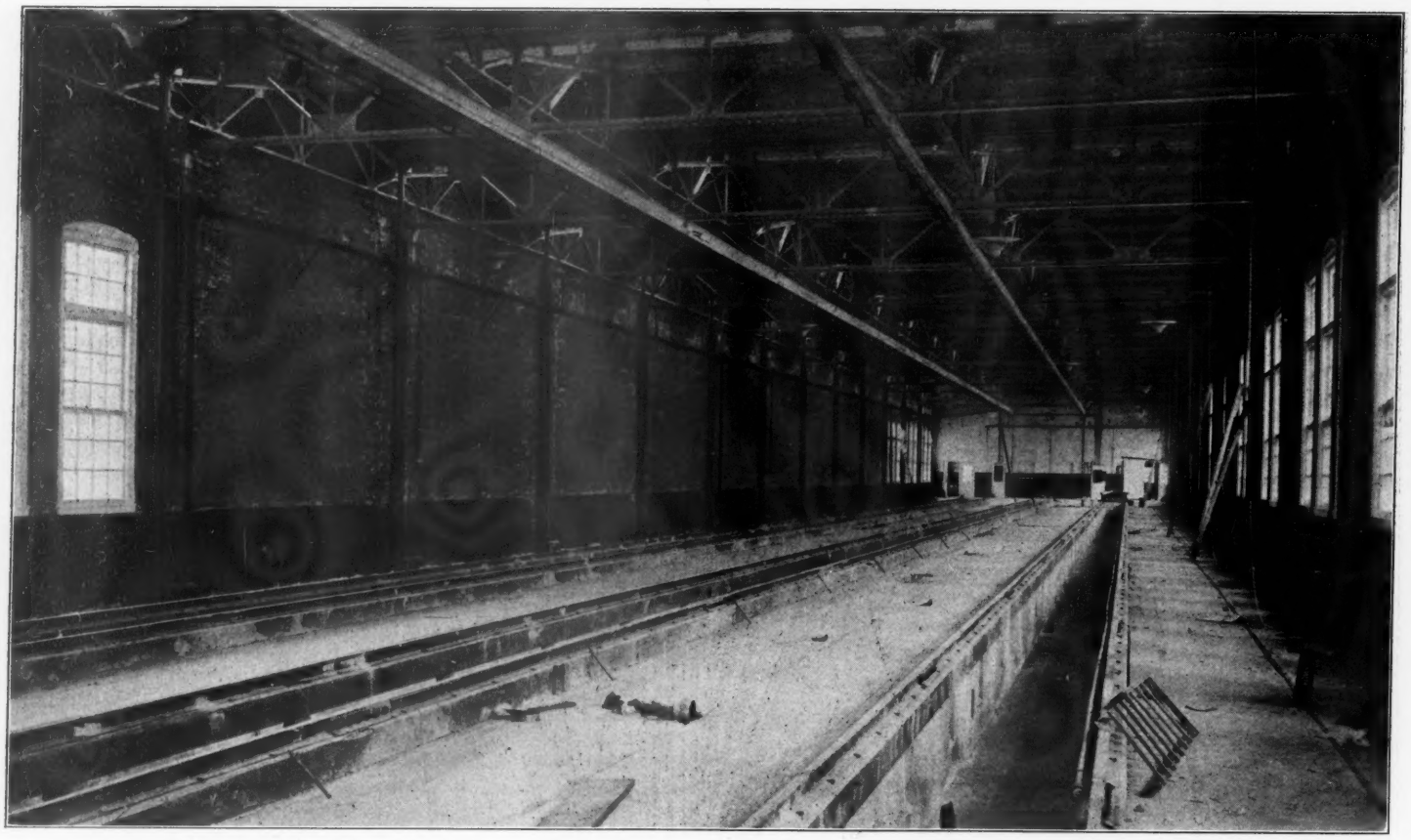


Fig. 3—Interior of Car Inspection Shops at North White Plains.

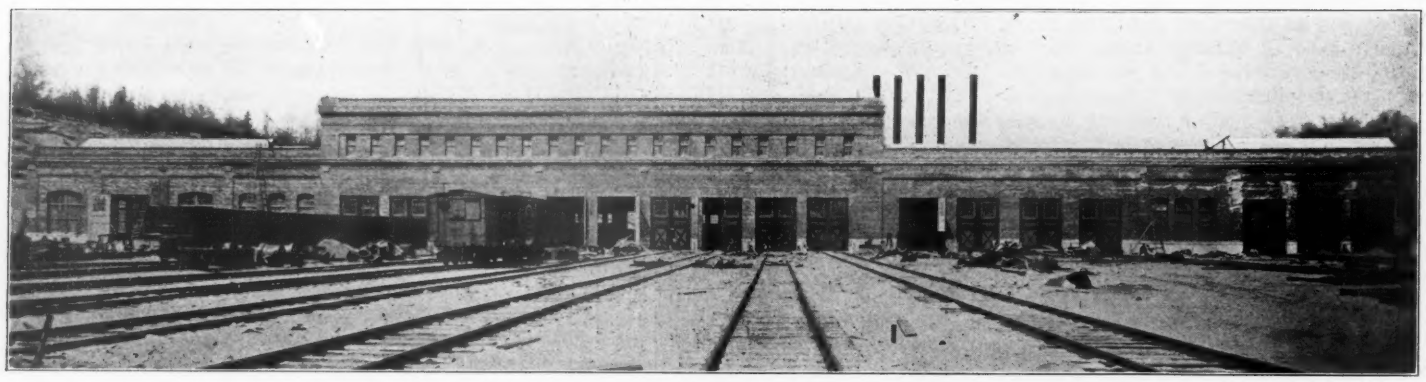


Fig. 4—Croton Shops, Looking North.

is a car inspection shed, but ample provision has been made for car storage tracks, for a future enlargement of the inspection shed to increase its capacity 100 per cent. and for an electric locomotive repair shed and shop large enough to accommodate 12 locomotives.

The site of the new shops was bottom land about 8 ft. below the grade of the proposed yard. Through it the Bronx river, a small and comparatively unimportant stream, flowed in a torturous course. The first work done was to divert the course of this stream through a channel 25 ft. wide dug along the west boundary of the yard. The yard was then filled in to the established grade with sand and gravel taken from a borrow pit in the immediate vicinity. The work of grading has been completed with the exception of the loop shown on the drawing, which will swing around the entire yard, crossing the railroad at the north end on an overhead bridge. This loop will be used for handling motor car suburban trains, but as the electrification has not yet been extended north of Mt. Vernon, work on the loop has not been rushed.

The car inspection shed is 450 ft. x 56 ft. with an extension 98 ft. x 56 ft. containing the machine and blacksmith shops, storeroom and offices. The building is brick with concrete foundations reinforced in the footings and with steel framed saw-tooth roof construction. The car inspection shed occupies 420 ft. of the length of the main building and has three tracks each holding a 5-car train. Ample light is provided in the side walls in addition to the lighting from the sash in the roof. The entrance to the shed is at the south end, which is closed with three wooden double-hinged doors. The north end of the building 30 ft. x 56 ft. is used for housing the steam coils and blowers used in the system of forced ventilation employed. The partition wall between this room and the inspection shed has three return air openings 4 ft. x 8 ft. 6 in. which are closed with Venetian blind iron shutters. The construction of these shutters is shown in Figs. 5 and 6. They are arranged to give any desired opening by locking the vertical rods on any one of the four shoulders shown on the rear elevation.

The inspection pits, three in number, extend the entire length of the shed. They are 4 ft. 2 in. wide and 3 ft. 8 in. deep at the center and ends, the floor sloping to points midway where they are 4 ft. 2 in. deep. This provides for perfect drainage. Fig. 7 shows a cross-section of the pits, which are of concrete throughout, mixed in the proportion of 1:3:6. A double grillage of ¾-in. reinforcing rods is laid in the bottom to prevent breaking of the monolith which rests on made ground. Anchor bolts ¾ in. in diameter and spaced 5 ft. apart are bedded in the side walls to hold the 10-in. x 10-in. stringers on which the rails are laid. Back of these stringers three 4-in. x 8-in. yellow pine planks are laid flush with the concrete floor to be used as bearing pieces for box jacks and other heavy work. The pits are entered by concrete steps at each end. A novel feature are the recesses and chases provided in the walls for receiving the pit lights and compressed air cocks.

The storeroom and smithshop occupy the north end of the extension or office building. The smithshop is 18 ft. 6 in. square and is partitioned off from one corner of the storeroom adjoining the

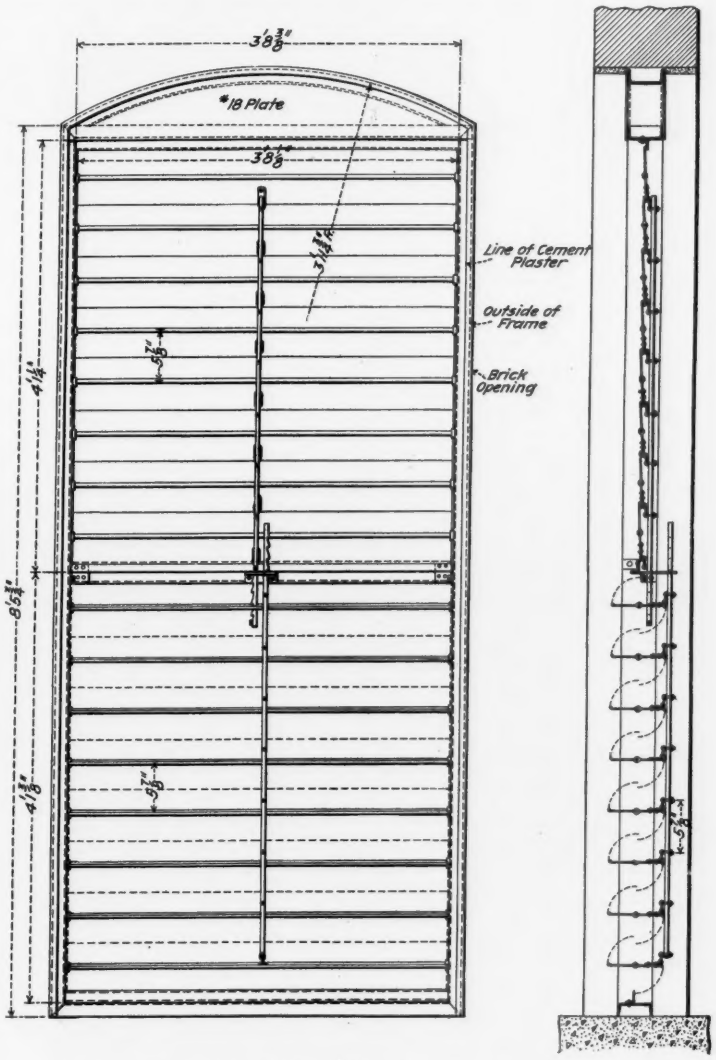


Fig. 5—Return Air Shutter in Fan Room Wall.

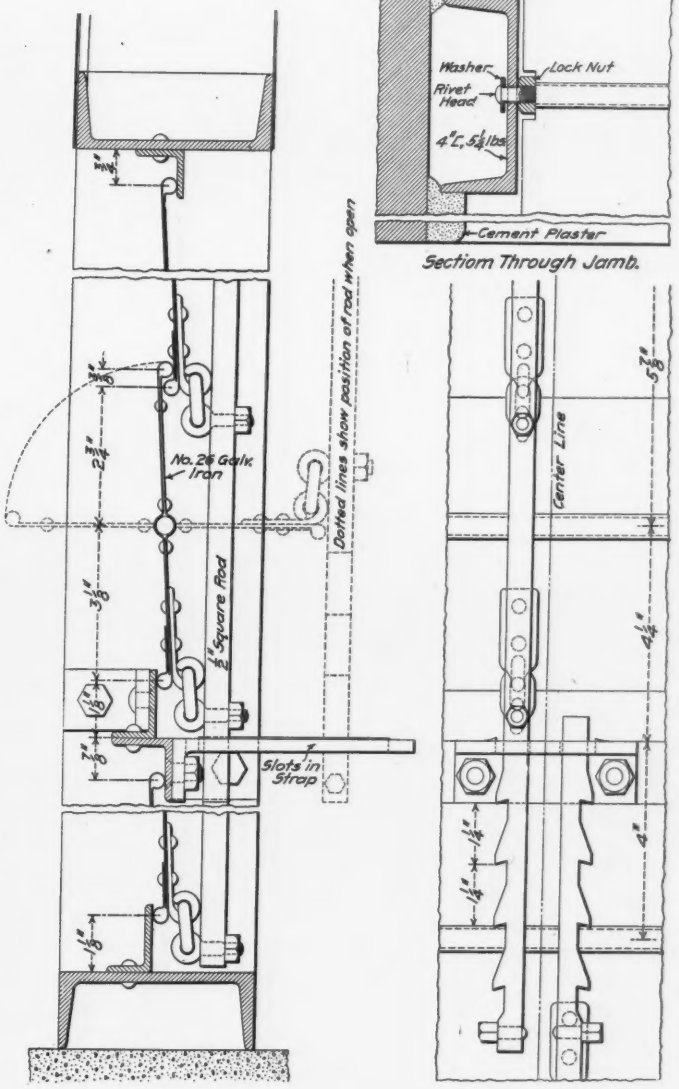


Fig. 6—Details of Return Air Shutter in Fan Room Wall.

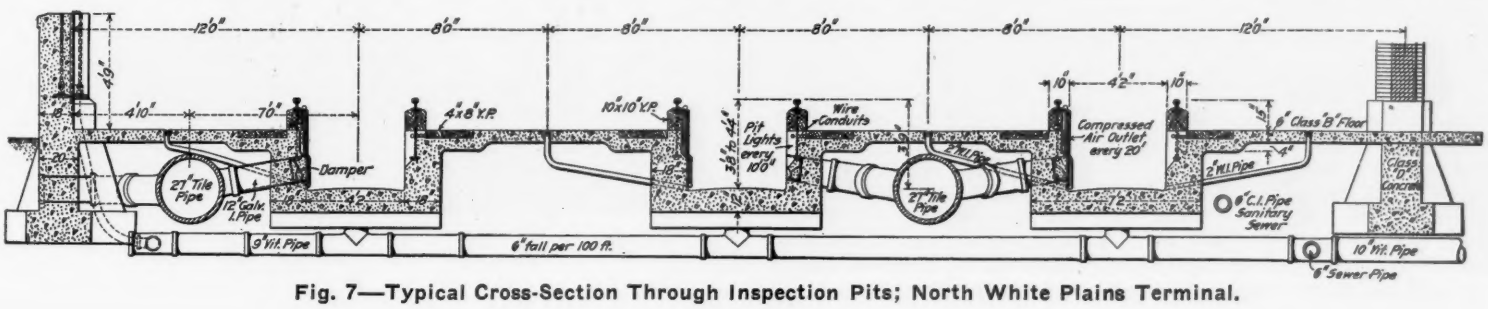


Fig. 7—Typical Cross-Section Through Inspection Pits; North White Plains Terminal.

machine shop. This partition is of wood lined with corrugated iron. The floor is 10 in. of cinders. The machine shop is along the east side of the building and is 18 ft. 6 in. x 79 ft. 6 in. It is connected with the inspection shed by a wide corridor along the south wall. The wash and locker room is in the center of the building. It is 51 ft. x 20 ft. and is enclosed by a wooden partition 13 ft. high. It contains at present 6 waterclosets, 5 urinals, 8 wash basins and 72 lockers. The offices on the west side of the building are separated from the wash room by a passageway. They occupy a space 38 ft. 4 in. x 10 ft. 9 in. and include a general office and private offices for the master mechanic and storekeeper.

The volume of the buildings to be heated is approximately 820,000 cu. ft. and provision was made for three changes or 2,460,000 cu. ft. per hour; the temperature to be maintained at 65 deg. The main hot air duct has been designed for an increase of 100 per cent. in the future and space was provided in the fanroom for a duplicate set of apparatus. The fan blower is the Buffalo Forge Co.'s type with a wheel 9 ft. in diameter and 4½ ft. wide. It has a normal capacity at 180 to 190 r.p.m. of 57,000 cu. ft. per min. at 1 oz. pressure. The fan is driven by a belt from a 30 h.p. direct current Westinghouse motor running at a speed of 1,025 r.p.m. on 220 volts. Current is supplied from the lighting circuit.

Steam for supplying the heater coils is brought from the power plant near the old roundhouse, about 400 ft. to the east and across the railroad. It is carried in a 10-in. cast iron pipe, which together with a 4-in. exhaust return, a 3½-in. air and a 3-in. live steam line are buried in a wooden conduit 3 ft. 10 in. x 4 ft. 2 in. All steam piping is covered with asbestos insulation and the conduit is thoroughly waterproofed.

The hot air duct system is entirely underground. The main duct, built under the north end of the inspection shed, is of concrete 4 ft. 6 in. wide x 5 ft. deep. It is connected by bruching to the fan already installed and is built with another opening to connect with the second fan when it is installed. This opening is temporarily closed with an 8-in. brick wall. Leading off from the main duct one next to the west wall and one between the inspection pits are two other circular concrete ducts about 150 ft. long terminating in vitrified tile pipe which decreases in size from 36 in. to 12 in. These ducts have Y branches of 12-in tile pipe leading into the inspection pits at intervals of from 40 to 45 ft. In addition to these main lines a 33-in. tile pipe duct leads to the office building. The outlets in the pits are provided with dampers. The concrete ducts are made of concrete mixed in the proportion of 1:3:6, reinforced with wire cloth.

The compressed air supply line for blowing out motors, testing brakes, etc., which leads from the power house terminates in a large storage reservoir outside the building. From this tank a 3½-in. header is carried across the north end of the building at a height of 17 ft. above the floor. From this header three 1½-in. pipe lines are dropped down under the floor and carried along the sides of the inspection pits for their entire length. These lines are provided with ½-in. outlets at intervals of 20 ft., the air cocks being set in the recesses in the pit walls.

Cars standing in the storage yard east of the inspection shed are heated by connections provided every 300 ft. with steam pipes connected with the power house. The yard is lighted by eleven 3-ampere 220-volt arc lamps equipped with reflectors and mounted on poles about 30 ft. above the yard level. The lighting of the buildings is all by means of incandescent lamps placed to give the best illumination.

SOUTH CROTON TERMINAL.

The South Croton terminal is on a much larger scale than that at North White Plains and is entirely new. Provision here has also been made for an increase of 100 per cent. in the present facilities. The general layout of the yard and buildings is shown in Fig. 8. It occupies a large tract of land between the railroad and the Hudson river which was originally a sandbank considerably higher than the present grade. This hill was leveled off with steam shovels and the material removed, which consisted of fine sharp sand, was used throughout the Electric Zone for filling and for concrete work. The greater part of the yard has been built and the remainder, including the loop at the north end, will be finished shortly.

The shops consist of a series of adjoining buildings contained under a common roof, the space occupied being L shaped and covering about 98,500 sq. ft. In addition to the existing buildings there will be built a 30-stall roundhouse and an electric locomotive inspection shed. The buildings are the same general type of construction as those at North White Plains, previously described.

The car inspection shed is 448 ft. x 56 ft. and contains three tracks with a total storage capacity of 21 cars. It may be entered from either the north or south end. The coil and fan is along the west wall instead of at the end and occupies a space 30 ft. x 84 ft. Similar shutters to those shown in Figs. 5 and 6 are used to close the return air openings. Adjoining the fan room to the north and south are two buildings each 25 ft. x 84 ft., which have mezzanine floors. The rooms on the lower floor adjoining the inspection shed are used for storerooms, locker-rooms and bench work. The rooms

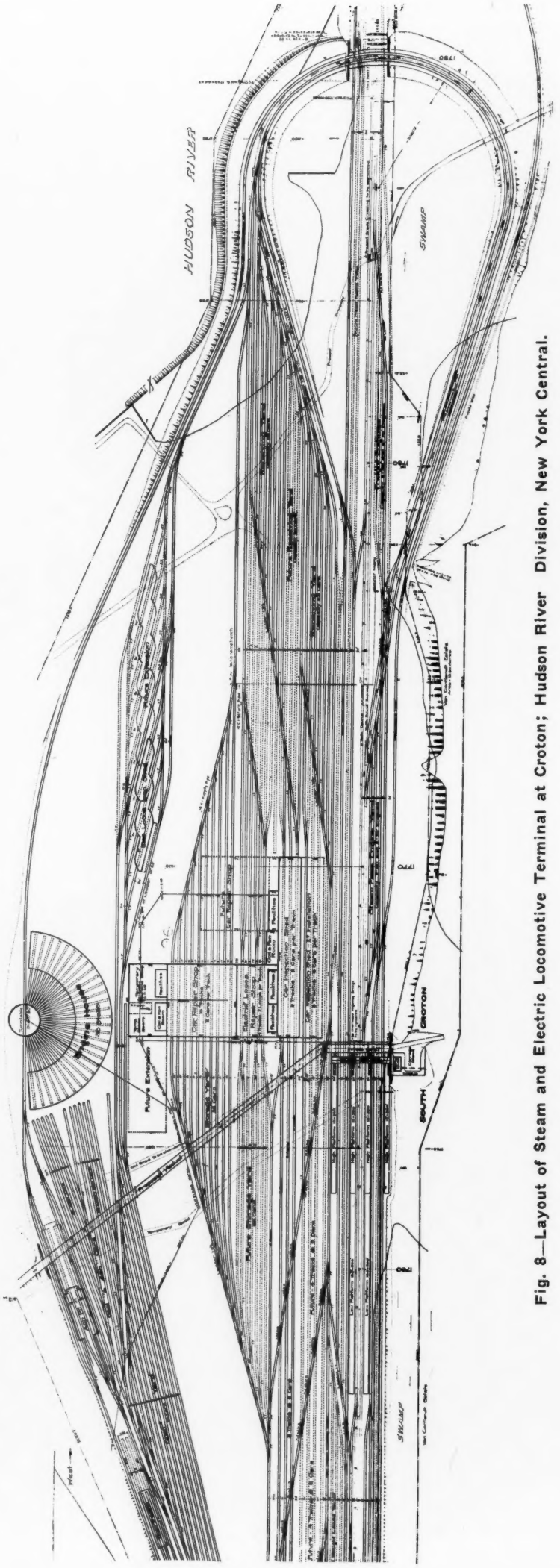


Fig. 8—Layout of Steam and Electric Locomotive Terminal at Croton; Hudson River Division, New York Central.

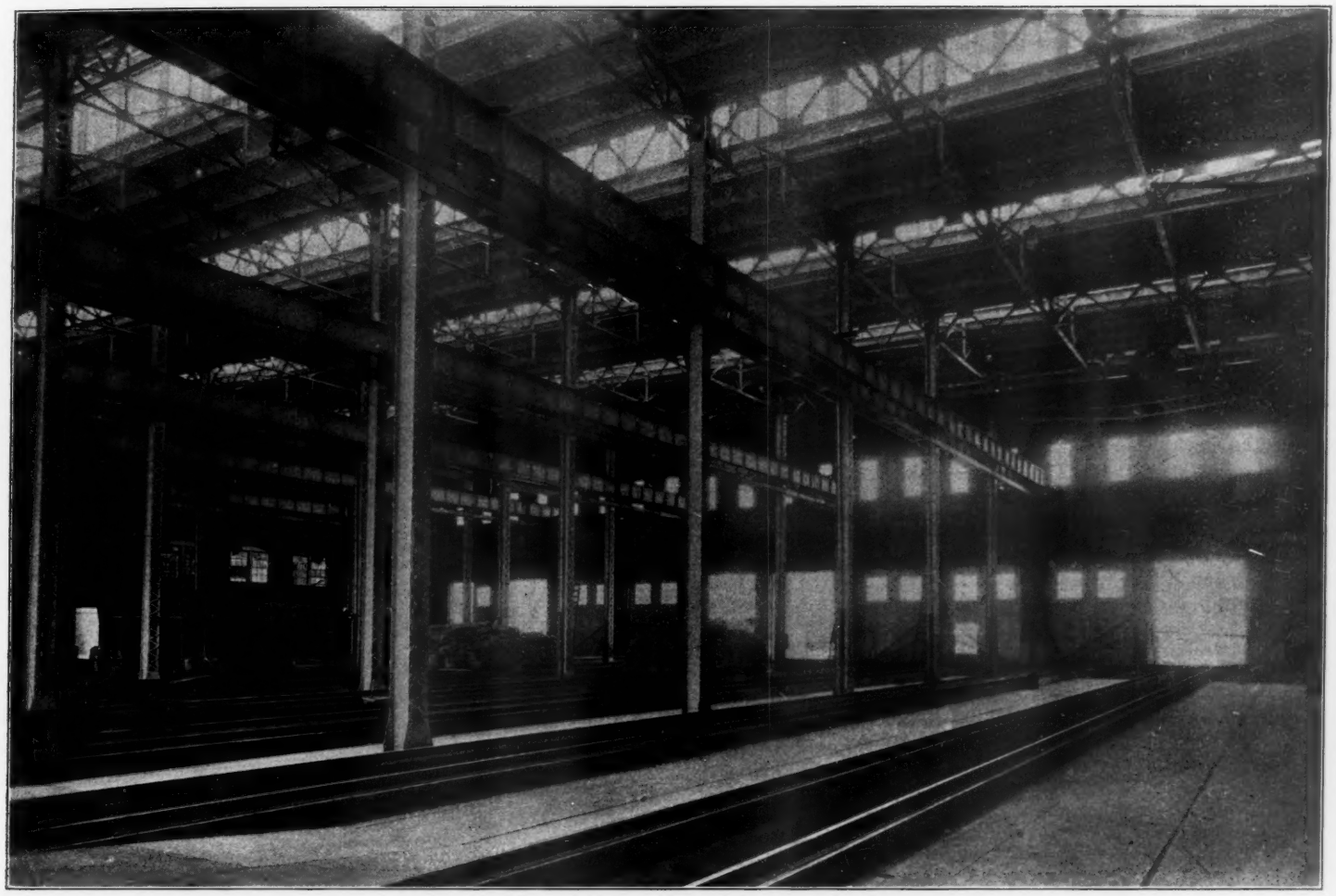


Fig. 9—Interior of Car Repair Shop at Croton.

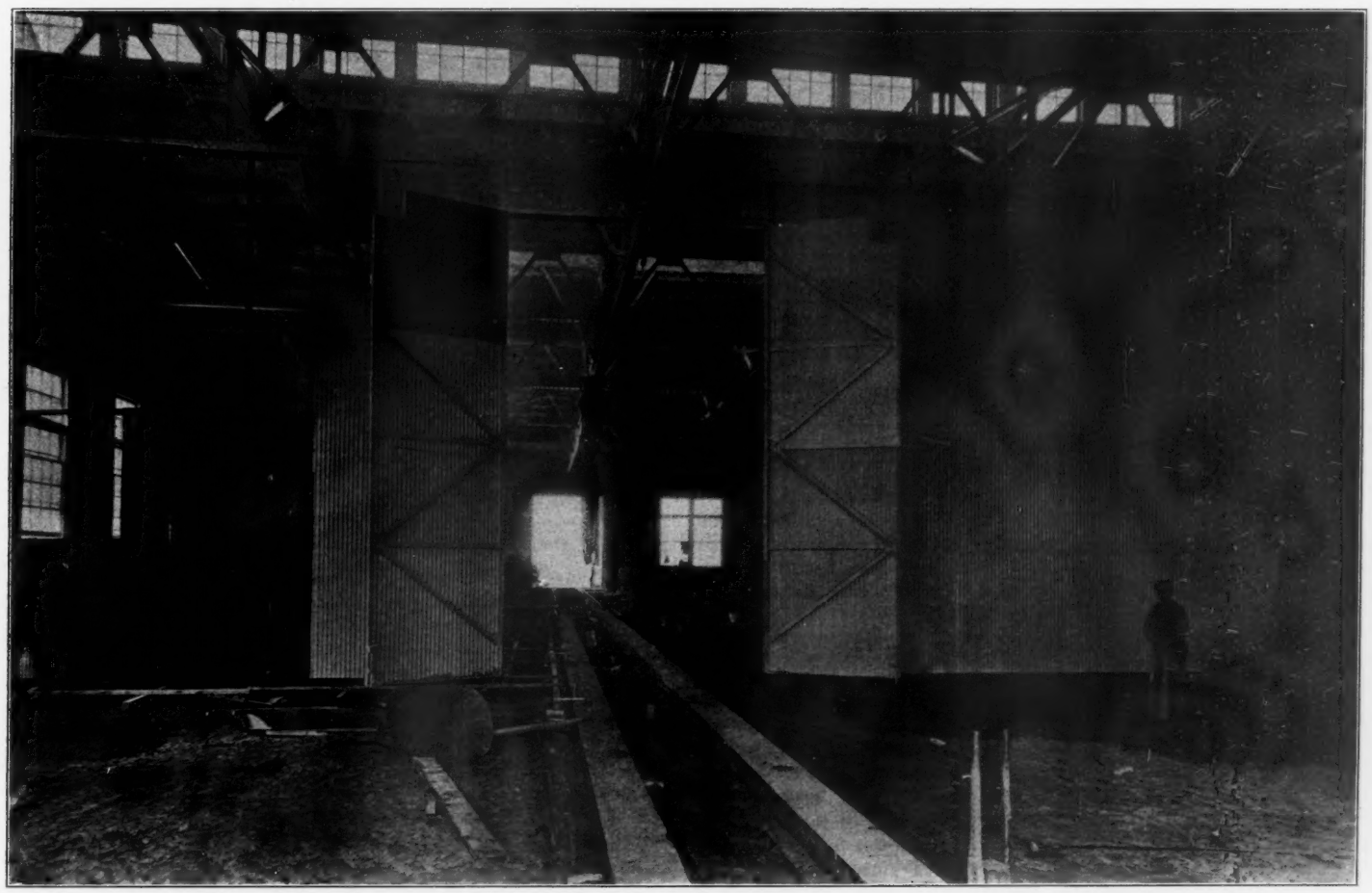


Fig. 10—Interior of Machine Shop at Croton Showing Trolley Hoist.

on the mezzanine floor are used for offices. The inspection pits are similar to those already described, except that no reinforcement was required in the concrete at the bottom.

Adjoining the building now used as a temporary power plant and which will later be used as a locomotive repair shop, is the car repair shop 176 ft. x 182 ft. This shop contains ten tracks and is provided with openings on both the north and south ends for admitting cars to all ten tracks. These openings are closed with double folding doors similar to those used in the inspection shed. Pits like those in the inspection shed are also provided under each track. This building and the machine shop are carried up to a greater height than the rest of the buildings in order to provide room for the traveling crane girders under the roof trusses. Separate locker rooms, offices, fan room and a smith shop adjoin the car repair shop on the west and occupy a space 30 ft. x 154 ft.

The machine shop 182 ft. x 55 ft. is in the extreme west end of the building. A space 48 in. long is partitioned off in the south end to provide a temporary storeroom. A standard gage track runs along the north wall of the repair shop connecting with all the pit tracks and continues through a corridor past the offices into the machine shop where it intersects another track running the length of the machine shop. This provides means for moving trucks, wheels or other heavy parts from the cars to the machines.

All the tools in the machine shop are supported on heavy concrete foundations. The floor consists of a 6-in. bed of tar concrete overlaid with 2¾ in. hemlock planks with a top floor of 1⅛ in. maple. Many of the machines are individually driven by motors, the others being belted to line shafting driven by a 35 h.p. motor. The following is a list of the equipment installed:

Machine.	Maker.	Size.	Drive.
Driving wheel lathe.....	.....	.....	24 h.p. motor.
Tire lathe	Pond.	42-in.	25 " "
Radial drill	Bickford.	60-in.	4 " "
Upright drill	Cincinnati.	28-in.	Belted.
Drill grinder	Sellers.	.....	Belted.
Tool grinder	Cincinnati.	No. 2.	1½ h.p. motor.
Milling machine	Cincinnati.	No. 4.	Belted.
Engine lathe	Schumacher & Boye.	36 in. x 14 in.	15 h.p. motor.
Plate rolls.	.....	.....	7½ h.p. motor.
Circular saw	Kip.	.....	15 " "
Band saw	.....	.....	5 " "
Punch and shear	Hilles & Jones.	No. 2; 25-in.	7½ " "
Centering machine	Pratt & Whitney.	.....	Belted.
Pipe threading machine.	.....	.....	Belted.
Planer	Pond.	30-in.	7½ h.p. motor.
Cutting off machine....	.....	.....	.....
Bolt cutter	Acme.	.....	Belted.
Slotter	Dill.	18-in.	7½ h.p. motor.
Grinder	Northern.	.....	10 h.p. motor.
Drill	Rochester Davis.	20-in.	Belted.
Shaper	Gould & Eberhardt.	24-in.	3 h.p. motor.
Sensitive drill	Fenn.	4-in.	Belted.
Speed lathe	Reed.	11 in. x 5 in.	Belted.
Arbor press	Greenard.	No. 5.	.....
Lathe	Hendey & Norton.	14-in.	Belted.
Lathe	Lodge & Shipley.	16-in.	5 h.p. motor.
Lathe	Lodge & Shipley.	24-in.	7½ h.p. motor.
Axle lathe	Niles.	No. 3.	25 h.p. motor.
Engine lathe	Lodge & Shipley.	30-in.	10 h.p. motor.
Boring mill	Bullard.	62-in.	15 " "
Wheel borer	Putnam.	No. 2.	10 " "
Wheel press	Niles.	48-in., 500-ton.	7½ " "

A temporary power plant has been installed in the space intended for a future locomotive repair shop. The boiler room 44 ft. x 60 ft. 6 in. contains five locomotive type boilers rated at 150 h.p. each under a working pressure of 125 lbs. Under the fireboxes suitable connections have been made for dumping the ashes into the sewer built underneath. Each boiler has an individual steel stack 60 ft. high and 34 in. in diameter. Feed water is supplied by a 6-in. x 4-in. x 6-in. duplex pump, but each boiler is provided with an injector for emergencies.

The engine room is 42 ft. x 60 ft. 6 in. and is separated from the boiler room by a corrugated iron partition. There have been installed here two 150 K.W. and one 100 K.W. direct connected vertical generator sets, one 8-in. x 12-in. x 12-in. vacuum pump and return tank, air compressor, fire pump and a 750 h.p. feed water heater. All surplus steam not taken up by the feed water heater can be delivered to the heating coils of the ventilating fans.

The two large generator sets supply current at 220 volts for light and power around the shops and the 100 K.W. set supplies current at 440 volts to the trolleys for moving cars in and out of the buildings. The air compressor is of the Franklin type and has a capacity of 500 cu. ft. of free air per minute at 110 r.p.m.

The heating and ventilating plant for the shops is divided into two groups, one serving the car inspection shed and the other the car repair shop and machine shop. Except for the larger size the apparatus installed is identical with that already described in connection with the North White Plains terminal. The volume of the buildings to be heated at present is approximately 3,000,000 cu. ft. and the ultimate volume provided for in the future is 5,300,000 cu. ft. The fans are designed to give three changes of air per hour. At present only three of the four fans have been installed. Each fan has a wheel 10 ft. in diameter and 60 in. wide and at 160 r.p.m. has a capacity of 72,000 cu. ft. of air per minute. Each fan is driven by a 35 h.p. Westinghouse motor.

Six of the ten tracks in the car repair shop are spanned by electric traveling cranes and the runway girders have been put up over the other four tracks to be used when a complete crane service is needed over all tracks. The cranes were built by the Alfred Box Co. and have a capacity of 18 tons with spans varying from 29 ft. 8 in. to 37 ft. 3½ in. The length of the runways is 175 ft. and the total lift is 30 ft. The hoist has a maximum speed of 25 ft. per minute, the trolley 250 ft. per minute and the bridge 150 ft. per minute. All operations are controlled from the floor.

In addition to the cranes in the repair shop a 5-ton electric traveling hoist, running on an overhead track of 15-in. 42-lb. I-beams, is provided. This runway is suspended from the roof trusses and is 536 ft. long, extending down the center of the machine shop, through a passageway and into the inspection shed. The carriage has four wheels running on the lower flanges of the I-beam track, 21 ft. above the floor. Both the hoist and trolley travel are operated by electric motors controlled from the floor.

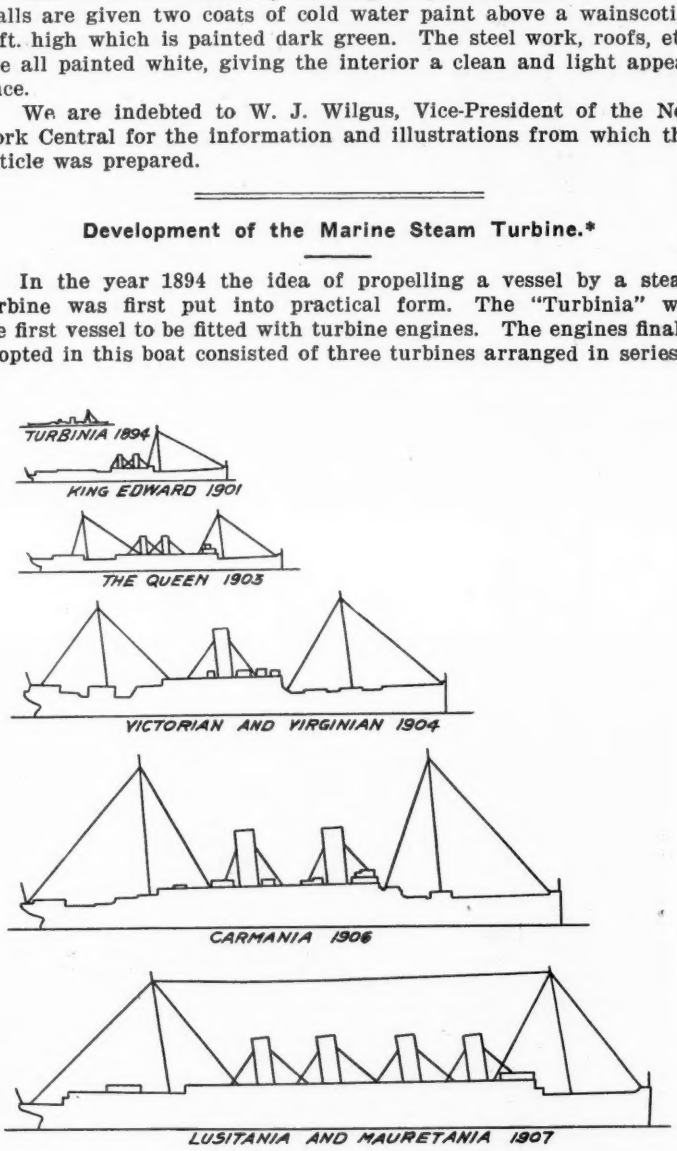
Both at Croton and at North White Plains great precautions have been taken against fire. All the buildings are piped with water mains with frequent outlets and there is a complete system of fire hydrants outside and around the yard. These are all connected to the fire pumps in the engineroom.

The interior of the shop buildings is painted white. The brick walls are given two coats of cold water paint above a wainscoting 6 ft. high which is painted dark green. The steel work, roofs, etc., are all painted white, giving the interior a clean and light appearance.

We are indebted to W. J. Wilgus, Vice-President of the New York Central for the information and illustrations from which this article was prepared.

Development of the Marine Steam Turbine.*

In the year 1894 the idea of propelling a vessel by a steam turbine was first put into practical form. The "Turbinia" was the first vessel to be fitted with turbine engines. The engines finally adopted in this boat consisted of three turbines arranged in series—high-pressure, intermediate-pressure and low-pressure—each driving a separate shaft with three propellers on each shaft. Following the success of the "Turbinia" the torpedo boat destroyers "Viper" and the "Cobra" were built and fitted with turbine marines for the British navy. The "Viper" held the record of being the fastest vessel in the world after attaining the phenomenal speed of 36.86 knots. Unfortunately, however, she ran aground in a fog and ultimately became a total wreck. The "Cobra" foundered in a storm. Thus, after two or three years of experimenting the "Turbinia" was the only vessel afloat fitted with turbine engines. The marine turbine was first adopted commercially in the Clyde steamer "King Edward," built in the summer of 1901. This vessel was successful and a second vessel, "Queen Alexandra," was built. There are now 31 turbine vessels in commercial service, representing a total of about 105,000 gross tons and 235,000 i.h.p. The following table



Development of the Turbine Steamer.

*From a paper read before the Institute of Marine Engineers in London, by the Hon. C. A. Parsons, and R. J. Walker.

shows the various steps in the adoption of the turbine engine for commercial purposes:

Name of vessel.	Owner.	Dimensions.	Gross tons.	Approx. I. H.P.	Year built.
King Edward.	Turbine Steamers, Ltd.....	250x30x17¾	562	3,500	1901
The Queen...	S. E. & Chatham Ry. Co..	310x40x25	1,676	7,500	1903
Virginian and Victorian..	Messrs. J. & A. Allan.....	520x60x41	10,754	12,000	1904
Carmania....	Cunard Steamship Co.,Ltd.	678x72x52	19,524	21,000	1905
Lusitania and Mauretania	Cunard Steamship Co.,Ltd.	785x88x60½	33,000	70,000	....*

*Now building.

The accompanying diagrams show the various steps in the development of the steam turbine for marine propulsion. The profiles of the vessels shown are drawn to the same scale, beginning with the "Turbinia" of 100-ft. length, 44-tons displacement, and 2,000 i.h.p., to the express Cunarders "Lusitania" and "Mauretania" of 785-ft. length, 45,000-tons displacement and 70,000 i.h.p.

The New Steel Cars of the Hudson Companies.

BY HUGH HAZELTON.*

The Hudson Companies are building a double set of tunnels from Cortlandt street, New York, through Jersey City and Hoboken to Christopher street, and thence by Sixth avenue to Thirty-fourth street, New York, and in designing the cars for this service the engineers have had three requirements constantly in mind:

First—The car must be absolutely fireproof.

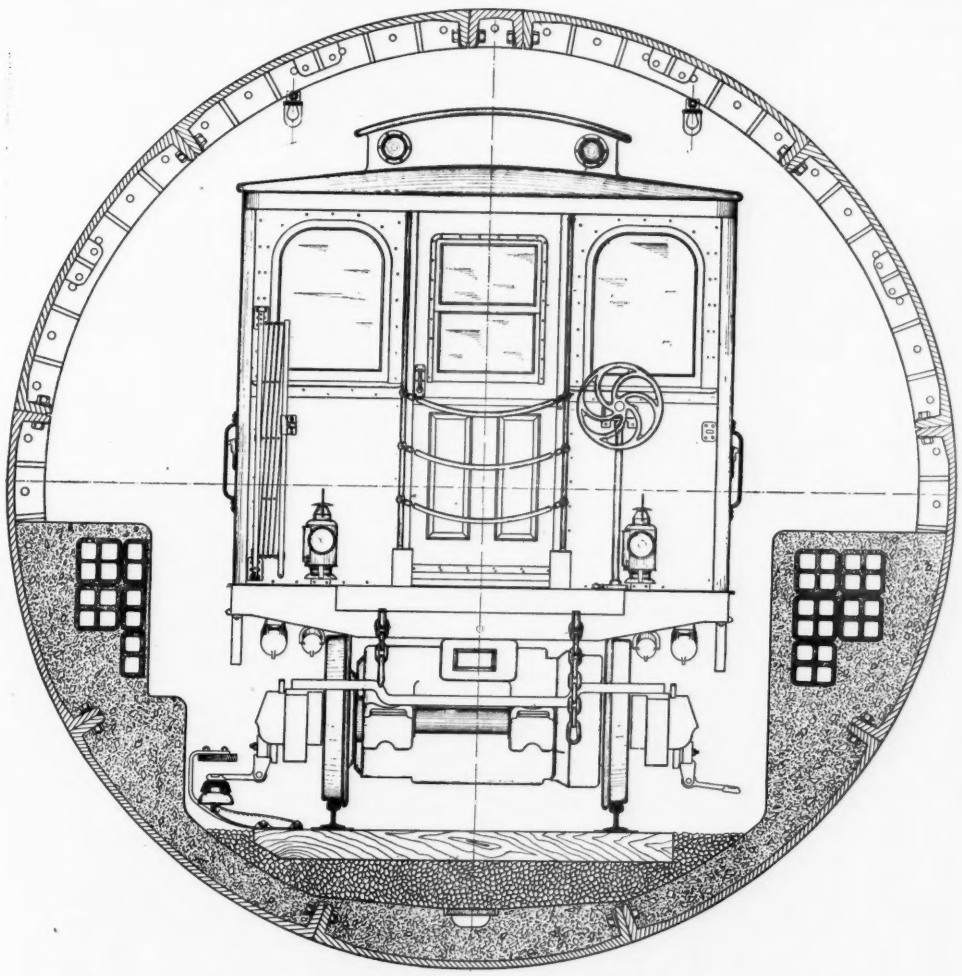


Fig. 1—Cross Section of Tunnels Showing End Elevation of Steel Car; Hudson Companies.

Second—Doors must be arranged so that passengers may enter and leave with least delay.

Third—The weight must be kept as low as is consistent with safety.

In order to make the car absolutely fireproof unusual precautions have been taken. The entire car body is made of steel, including doors, roof and headlining. The floor is made of "monolith" cement laid on steel, with ¼-in. finish of carborundum cement, which is used as a substitute for maple strips. The seat cushions and backs are covered with a metal fabric instead of with rattan. All insulated wires are covered with an asbestos braid and are placed in iron conduit pipes. The magnet coils of the control equipment are insulated with mica and asbestos in place of the usual covering of cotton tape.

In order to facilitate rapid movement of passengers, the car is designed as indicated in Fig. 2, with wide center doors, side seats, and an unobstructed passageway between the car platforms and the interior of the car. This arrangement minimizes the time of station stops without sacrifice of carrying capacity. At the terminals the cars will discharge passengers on one side to an incoming platform and will receive passengers on the opposite side from a special outgoing platform. These provisions are necessary owing to the density of traffic and the close headway of trains during the rush hours.

In a local service like that of the Hudson Companies the stations are from one-third to one-half a mile apart, and a large percentage of the power for operating the cars is required for their acceleration. For this kind of service it is desirable to minimize the weight of the cars as much as considerations of safety will permit. The problem which presented itself to the engineers of the Hudson Companies was to design a steel car with center doors and of the least possible weight.

The type of construction used on Interborough subway steel cars was at first considered, but was not found applicable on account of the decision to use center doors. The unbroken side of the Interborough car below the window sill forms a plate girder about 3 ft. deep. To introduce a center door in a car of this type would have made it necessary to cut the girder in two, and no satisfactory way was found to frame around the door without adding materially to the weight.

The use of drop frame girders at each side of the car below the floor line was also considered, but as such girders are limited in depth by clearance requirements to 16 in. or 18 in., it would have been necessary to make them of heavy sections which would have added materially to the weight of the car.

The truss frame illustrated in Fig. 3 was finally designed as the best solution of the problem. This truss frame is arranged in five panels, the center door occupying the middle panel. As the depth of this truss is about 7 ft., it follows that its weight, for a given strength, is much less than that of any girder or truss construction which can be placed below the car floor. The bottom chord of the truss is a 6-in. channel carried below the door sills and extending from end to end of the car. The top chord is a similar channel placed above the doors and extending the length of the car. The vertical members of the truss frame are 8-in. channel posts spaced at uniform distances, and placed between pairs of windows. Below the window sills these posts are braced by diagonal members to the bottom chord. Above the window sill the posts are reinforced by angle irons and plates, which arch over the pairs of windows and are riveted to the top chord. At the center door the top and bottom chords are reinforced by bulb angles, and similar bulb angles are riveted to the bottom chord below the end doors to furnish additional support for the car platforms. The truss frame is designed to carry the entire weight of the car with full passenger load with a fiber stress not to exceed 12,000 lbs. per sq. in. in any member.

The underframe of the car is shown in Fig. 4. The side sills are made of the 6 in. channels already described as a part of the truss frame. The center sills are 6-in. I-beams, which run from end to end of the car. The needle beams are composed of angles with truss rods and turn buckles. The attachment of the needle beams to the side sills is made by means of bent plates which serve also to stiffen the posts against side pressure.

The end sills have been made unusually strong in order to distribute the strains due to impact to the center and side sills. A shelf angle is secured to the end sill for the support of the drawbar. This shelf angle furnishes a stronger support than the sector bar usually employed for the purpose.

To prevent the telescoping of car platforms in the event of a collision, two heavy steel castings, shown in Fig. 5, have been riveted to the ends of the center sills. These castings extend about 8 in. above the top of the buffer timbers, and if the buffer timber of one car is forced up over that of the adjacent car, it will be stopped by the steel castings before damage is done to the end of the car.

The sheathing of the ends and sides of the car consists of steel plates $^1/_{16}$ in. thick. These plates are riveted to the truss frame after the latter is in place, and none of the rivets which hold the

*Consulting Engineer, 100 Broadway, New York City.

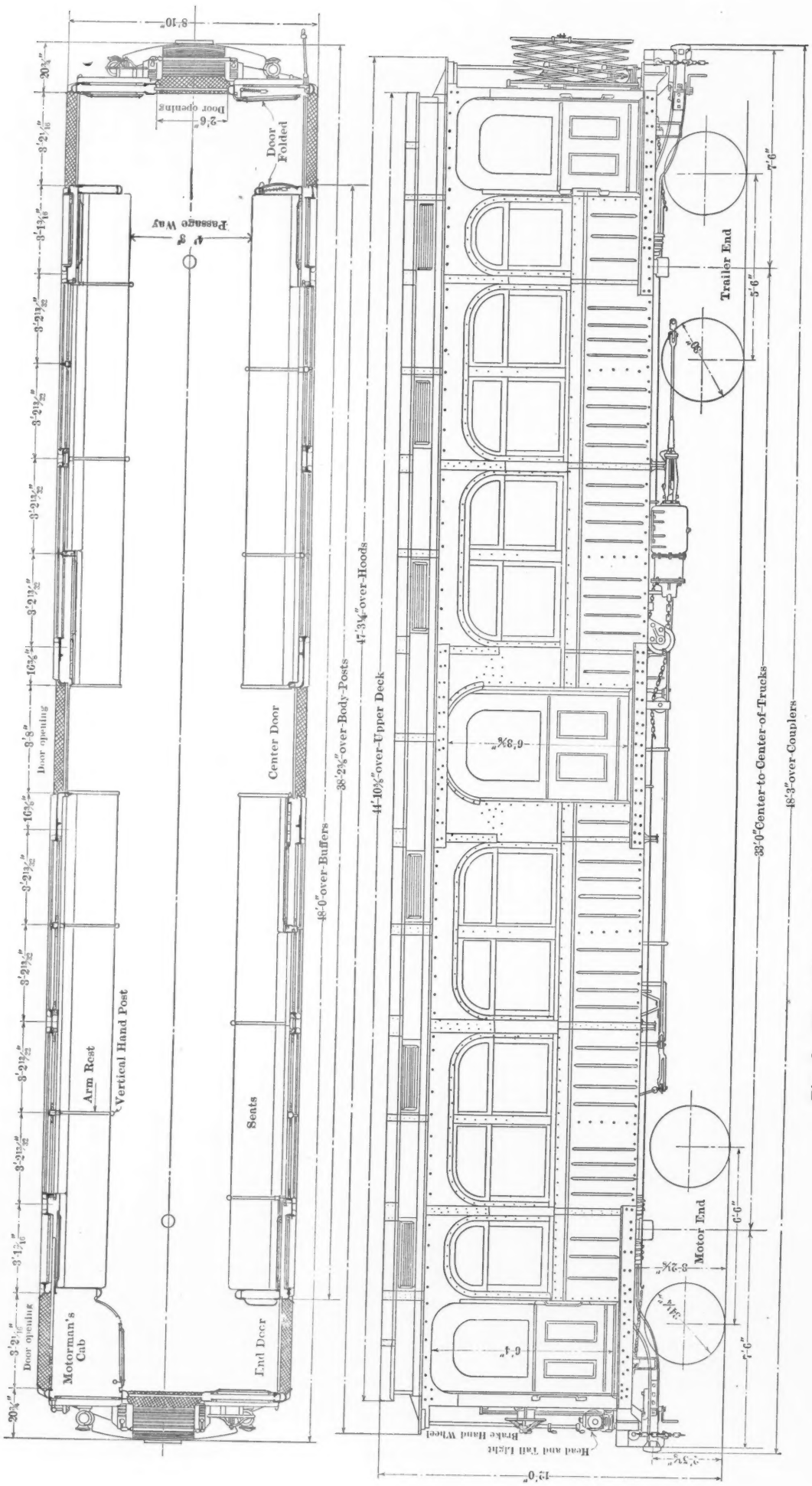


Fig. 2—Floor Plan and Side Elevation of Steel Passenger Car; Hudson Companies.

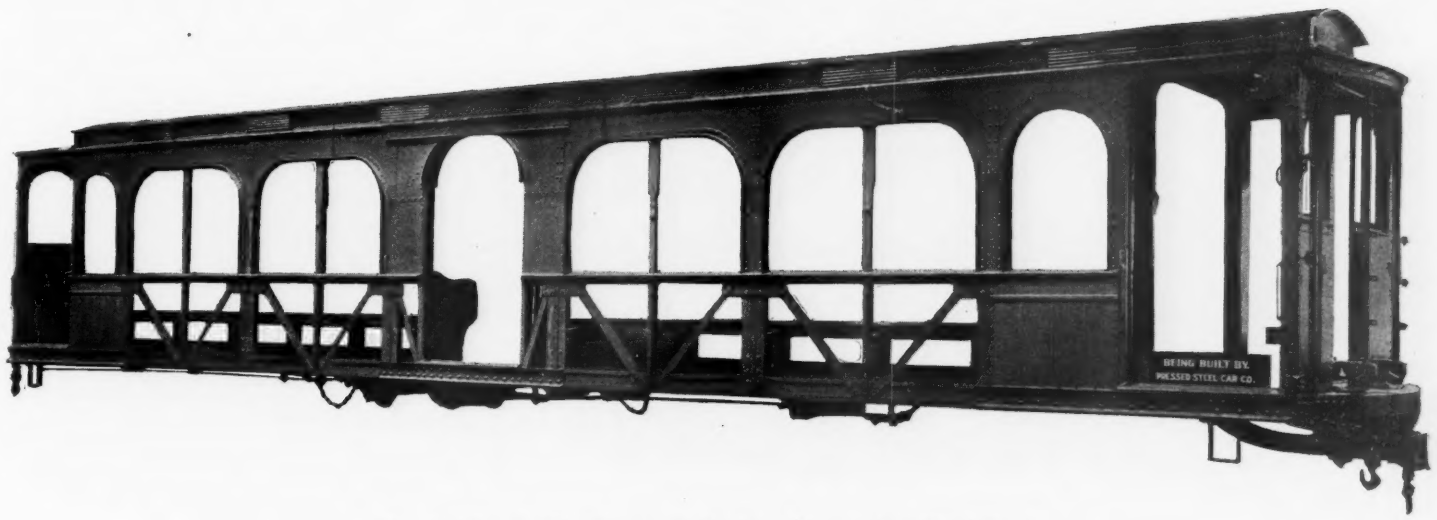


Fig. 3—Truss Side Frame of Hudson Companies' Steel Cars.

truss frame together pass through the sheathing. Therefore, the plates may be removed for repairs without disturbing the truss frame. The roof is made of $^1/_{16}$-in. steel plates coated on both sides with lead. The roof plates are supported by angle irons bent to conform to the shape of the roof and spaced about 14 in. apart. The plates are secured in place by ¼-in. rivets with heads soldered, and all seams between plates are lapped and soldered.

The headlining and side panels on the interior of the car are of steel $^1/_{32}$ in. thick, and all window guides and post covers are made of steel plates pressed to the required shapes. The floor is made of "monolith" cement laid on galvanized "Keystone" iron, which securely holds the cement down to the metal. The top surface is coated with a layer of cement containing about 30 per cent. of carborundum. This forms a hard wearing surface, and the sharp particles of carborundum prevent slipping.

The longitudinal seats are provided with partitions, as shown in Fig. 6. These partitions consist of steel plates which extend from the seat cushion to a height a little above the shoulder of a seated passenger. The top edge of the partition is finished with a 1-in. pipe bent to a graceful curve. These partitions are high enough to form a support to the passenger and thus obviate the disagreeable effect due to the sudden starting and stopping of trains. The Hale & Kilburn Manufacturing Company, which is furnishing the seat cushions and backs, has developed for the Hudson Companies' cars a metal fabric which is to be used as a covering in place of rattan. The frames of the cushions are made of pressed steel, and the seats are, therefore, fireproof throughout.

A vertical hand rod is located at each of the seat partitions; this rod extends from the seat to the ceiling fixture which supports the hand strap rod. The vertical hand rods furnish convenient supports for standing passengers.

Steel sliding doors are provided at the sides of the car and in the vestibuled ends. Each door is supported on a ball-bearing hanger which runs on a track above the door. A piece of rubber hose is attached to the edge of the door to prevent the possibility of pinching the fingers of passengers when the door closes. The doors are being furnished by Hale & Kilburn Manufacturing Company, and the ball-bearing hangers by the Pitt Car Gate Company.

The doors are operated by air cylinders controlled by the guard. The piston has a stroke of about 15 in., and in order to increase the movement to equal the door travel a rack and pinion is used. The mechanism is so arranged that the door moves up to the end door post, but does not strike against it. The air cylinders are connected by pipes to air valves, which are located at the ends of the car. The guard opens and closes the doors by operating these air valves. This door operating mechanism is supplied by the Burdette & Rountree Manufacturing Company. To prevent the starting of the train before all doors are closed, it is proposed to provide

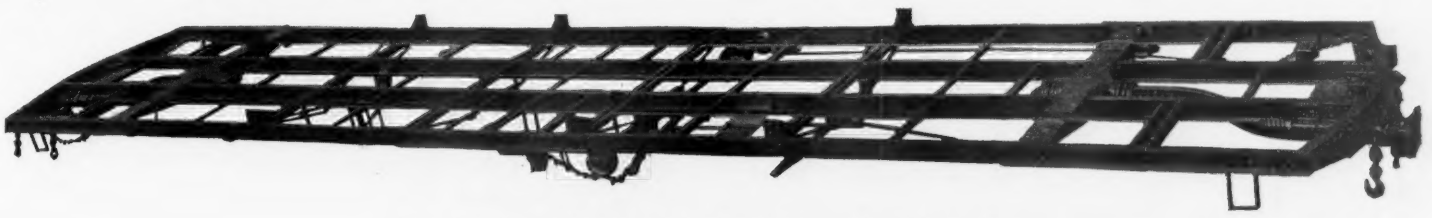


Fig. 4—Underframe of Hudson Companies' Steel Car.

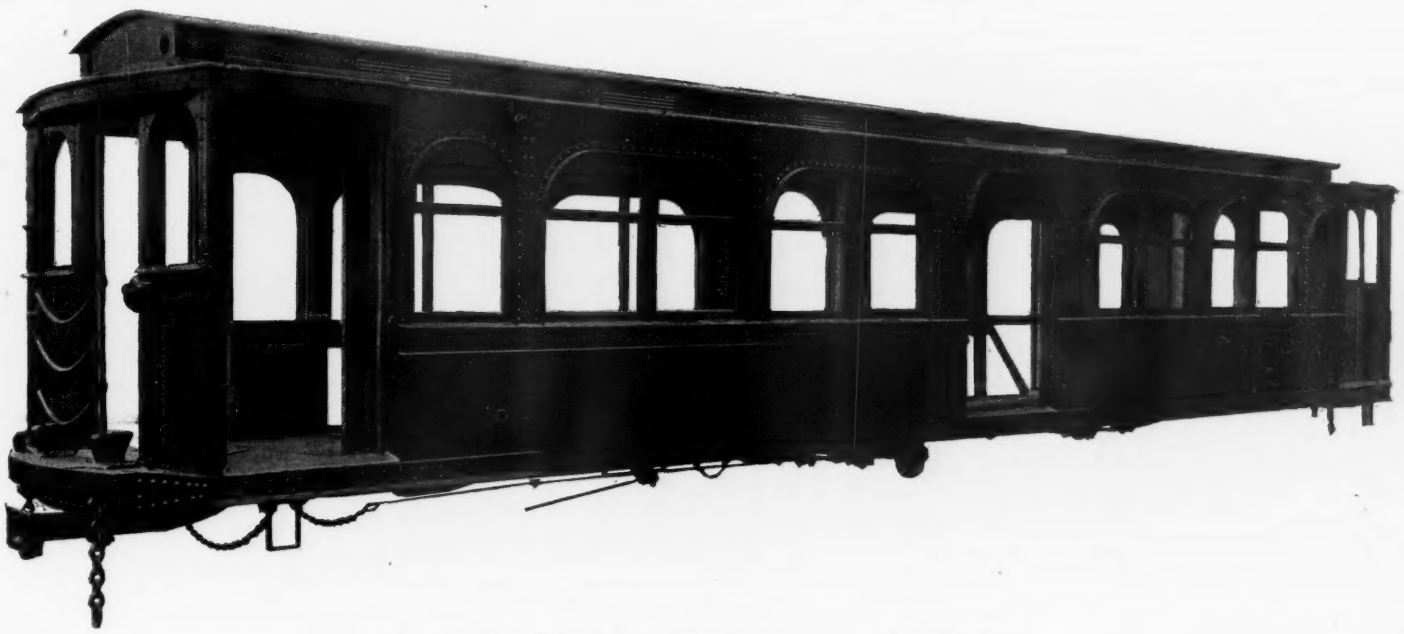


Fig. 5—Side Elevation of Hudson Companies' Steel Car.

an electrical signal wire throughout the train, with a bell or indicating lamp in the motorman's cab, and with contacts at each door so arranged that every door must be closed before the motorman receives the signal to start.

Each car is equipped with 30 10-c.p. incandescent lamps, two of which are placed above each vestibule. Switches are provided so that the current may be transferred from the two vestibule lamps, in the end occupied by the motorman, to the two lamps in the destination signals. As the cars are to be operated exclusively in tunnel service, the 30 lamps will be lighted continuously. In addition to the 30 lamps in the regular lighting system, each car is provided with four emergency lamps, which are supplied from a 60-volt storage battery on each car. In case the power goes off the line, the emergency lamps continue to be lighted from the battery. The storage battery consists of 30 cells having a discharge rate of 1½ amps. for eight hours. The battery is placed in series with the six circuits of five lamps each, and the four emergency lamps are connected across the terminals of the battery. The four 60-volt lamps take nearly the same number of amperes as the 30 lamps in the main lighting system, so that the battery normally "floats" on the line. The storage batteries are furnished by the Gould Storage Battery Company.

The destination signals are placed above the ceiling of the vestibule at each end of the car. Each signal consists of a stationary lamp surrounded by a cylinder containing four segments of glass of different colors. This cylinder may be turned from the vestibule by the guard or motorman. The lamp is accessible from the vestibule by means of a hinged door at the bottom of the cylinder. A fixed lens is placed in front for each destination signal. The destination signals were designed by Hudson Companies engineers and furnished by Adams & Westlake Company.

Two oil headlights are placed on the front end of the forward car in a train, and two similar lanterns are placed at the rear end of the rear car, showing red to serve as "tail" lights. These lanterns are also furnished by Adams & Westlake Company.

The heaters are of the panel type placed below the seats. The heater coils are arranged in two circuits, which, at 600 volts, take 7 amps. and 14 amps., respectively. The heaters are furnished by the Consolidated Car Heating Company.

The drawbars are of the radial type designed for clearances with cars on a 90-ft. radius curve. The drawbars are made of 85-lb. bent rails with Van Dorn couplers.

The cars are equipped with Westinghouse automatic air-brakes. The type of brake is designated as Schedule A. M. M., which includes the following features:

Quick recharge of auxiliary reservoir.
Quick service application of brake.
Graduated release of brake cylinder pressure.
High-pressure emergency application.
Electro-pneumatic operation of triple valves.

This air-brake equipment is intended especially for the class of service required of Hudson Companies cars, and is of the latest and most improved design. Each car is supplied with air by a Westinghouse D-2-E.G. motor-driven air compressor, which has a piston displacement of 20 cu. ft. of air per minute. In addition to the air-brakes, each car has a complete system of independent hand-brakes.

The latest type of Sprague-General Electric multiple-unit control has been adopted, and a number of improvements have been made in the materials used for insulation to render them fireproof. For example, in the contactor and reverser coils mica and asbestos have been substituted for cotton tape, and all insulation in molded forms has been made of fireproof material. The control equipment on each car includes a current limit relay which provides automatic acceleration of the train with predetermined current in the motors. This relay, however, does not prevent manual operation of the master controller at less than the predetermined current, if desired. The motor circuit is protected by a copper ribbon fuse with magnetic blowout, and, in addition, by a circuit-breaker with tripping and resetting coil. The circuit breakers in all of the cars in the train may be set or tripped by means of a switch located in the motorman's cab of each car. A bus line cable is installed on each car which will connect the contact shoes of all cars in the train. The bus line cable prevents loss of current when passing through crossovers.

The motor and trailer trucks are of the M. C. B. type, and were built by the Baldwin Locomotive Works. The motor trucks have the following general dimensions:

Wheel-base, 6 ft. 6 in.
Wheel diameter, 34¼ in.
Tires, rolled steel, 5¼ in., M. C. B. tread.
Axles, hammered steel, 6 in. diameter at center, 6½ in. at wheel seat.

The wheels have cast-steel spoke centers and rolled steel tires held on by double retaining rings. One wheel on each axle has an extended hub upon which is shrunk the driving gear.

The general dimensions of the trailer truck are:

Wheel-base, 5 ft. 6 in.
Wheel diameter, 30 in.
Tires, 5¼ in., M. C. B. tread.
Axles, hammered steel, 4¾ in. at center, 5¾ in. at wheel seat.

The wheels are of solid steel, forged, and were made by the Standard Steel Wheel Company.

Each car is equipped with two 160-h.p. motors furnished by the General Electric Company and of the type known as G. E. No. 76. This motor has been specially designed for the Hudson Companies service, but follows closely the design of the G. E. 66, a motor which has given such good service on the Manhattan Elevated. In the G. E. 76 motor the armature speed has been reduced and improvements have been made in commutation.

The contact shoes are of the hinged type, similar to those used in the subway cars of the Interborough Rapid Transit Company. The shoe is pressed down on the contact rail by springs which give a tension of 15 lbs. An enclosed fuse protected by an asbestos-lined wooden box is located directly above each contact shoe. The fuse base is mounted on springs in order to reduce the vibration, and thereby prolong the life of the fuse link. Each fuse is designed to carry 650 amps. continuously.

The cars above described were designed and built under the direction of L. B. Stillwell, Consulting Electrical Engineer, and F. M. Brinckerhoff, who has followed the details of this work and to whom many of the novel features are due.

Fifty cars have been ordered for the initial operation of the Hudson Companies tunnels. Forty of the car bodies are being built at Berwick by the American Car & Foundry Company and 10 car bodies at McKees Rocks by the Pressed Steel Car Company. The writer is indebted to the latter company for several of the photographs which illustrate this article.

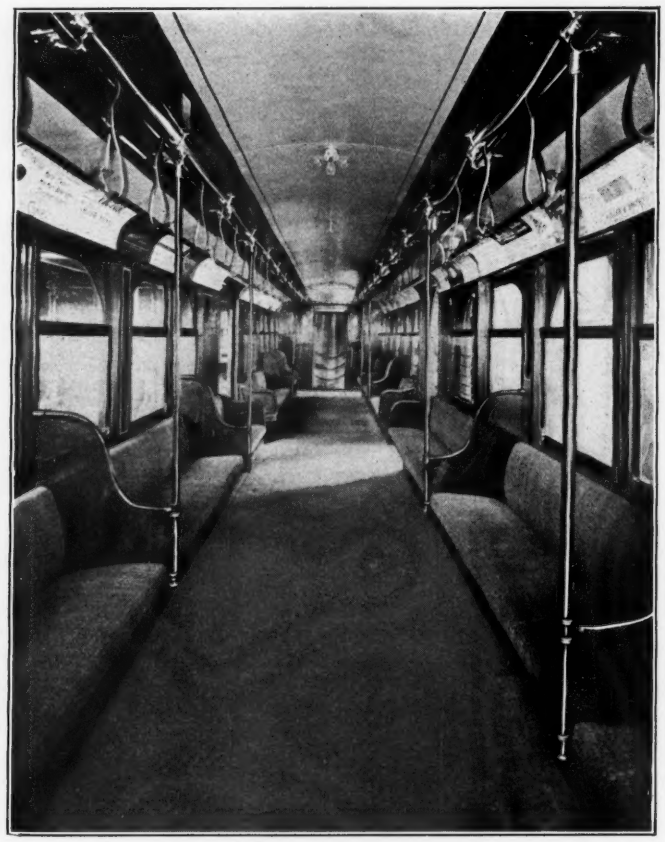


Fig. 6—Interior of Steel Car; Hudson Companies.

The first one of these cars is at present being equipped with electrical and air-brake apparatus. The 50 cars are to be ready for operation in September, and it is expected that the line between Hoboken and Sixth avenue, New York, will be opened for passengers a few weeks later.

Inspector Hansen, of the Prussian State Railroads, has communicated to the official engineering journal the result of numerous measurements of tracks on curves. He found very great variations from the standards which were followed in laying the tracks, and especially in the radius of curves. Not infrequently he found on a curve where a radius of 300 meters had been prescribed, places where the actual radius was more than 1,000 meters and other places where it was less than 180 meters. Hansen recommends for testing the curves a chord the length of three rails, with offsets to the prescribed position of the curved rails. In addition to this, on curves traversed by fast trains he tests with shorter chords with offsets to the rail position not less than two meters apart.

Heating and Ventilating Equipment for Paint Shops.

The new paint shop of the New York, Ontario & Western at Middletown, N. Y., is a frame building 384 ft. long and 66 ft. wide, housing three tracks with ample space between the cars. The problem of heating and ventilating the building was carefully studied with the view of providing ample heat and air at a uniformly moderate temperature in order to obtain the best results in applying paint and varnish to the cars. A system of forced circulation of warm dry air heated at a central point and distributed uniformly at frequent points throughout the entire building by means of underground conduits was decided on and installed. This equipment consists of an 8-ft. fan wheel enclosed in steel plate casing connected with a casing containing the heater. In this heater are compactly arranged ten sections containing 6,800 ft. of 1-in. pipe, across which the air is drawn into the fan and thence discharged to the distributing system. The rapidity of air flow produced by the fan increases the efficiency of the heating surface from 300 to 500 per cent. above that of the same area exposed in still air.

A direct-connected 8-in. x 12-in. engine drives the fan up to a maximum speed of 200 r.p.m., which gives a velocity of about 3,500 ft. per minute through the discharge pipe. The heater is designed for the use of high pressure steam, and arranged so that the exhaust from the fan engine may be completely utilized.

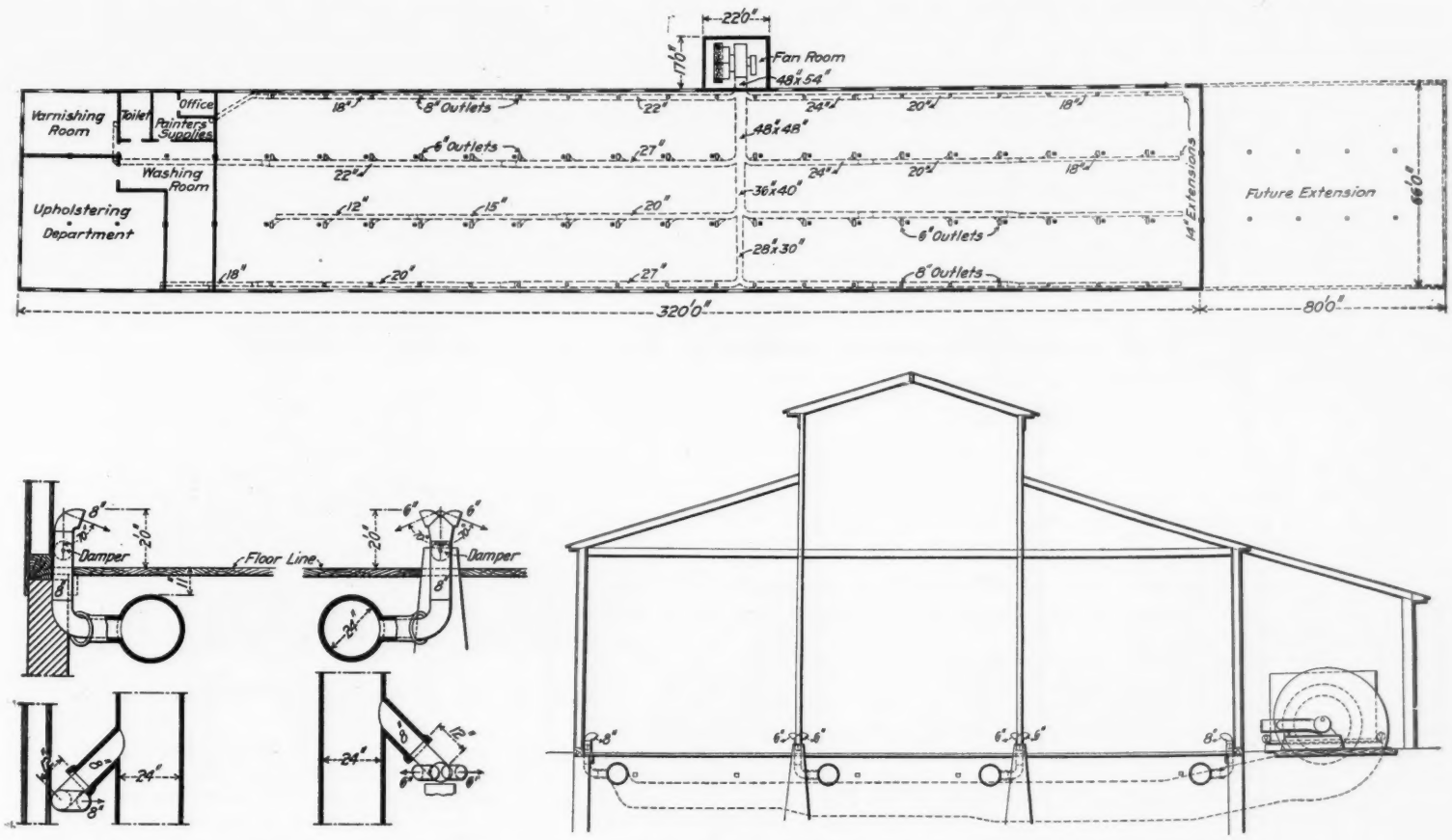
The complete apparatus is placed in a small lean-to mid-length of the main building. Its central position reduces the cost of the distributing system to a minimum. Under the floor and alongside the walls and the column piers run four tile distributing pipes branching from the main brick cross duct from fan. Branches from these pipes lead to the floor level, the upper portion of each branch being made of heavy galvanized iron, and so designed as to throw the escaping air at an angle toward the floor. As a consequence, there is maintained at the floor level a constantly changing volume of warm air which naturally ascends across the painted surfaces of the cars, thereby increasing the rate of drying. The constant replacement of the rising air by the incoming heated air insures a fresh warm atmosphere, conducive to rapid drying.

The outlets, which range from 6 in. to 8 in. in diameter, are spaced 16 ft. apart so that practically perfect distribution and mixing is secured. Those in the middle of the building are protected from injury by the adjacent columns. The building is warm where warmth is desired, at the floor The small rooms at the end of the building are heated by the same system through risers extending up from the underground ducts.

In other arrangements of the blower system the air is distributed through overhead pipes carried upon the roof framing and provided with long discharge pipes extending downward to near the floor. Each method has its advantages, but the results secured at Middletown prove that the underground system can certainly give satisfactory results.

The building and its equipment was designed by C. E. Knickerbocker, Engineer of Maintenance of Way. All the heating apparatus was furnished by the B. F. Sturtevant Co., Boston, Mass.

Interior of New Paint Shop at Middletown; New York, Ontario & Western.

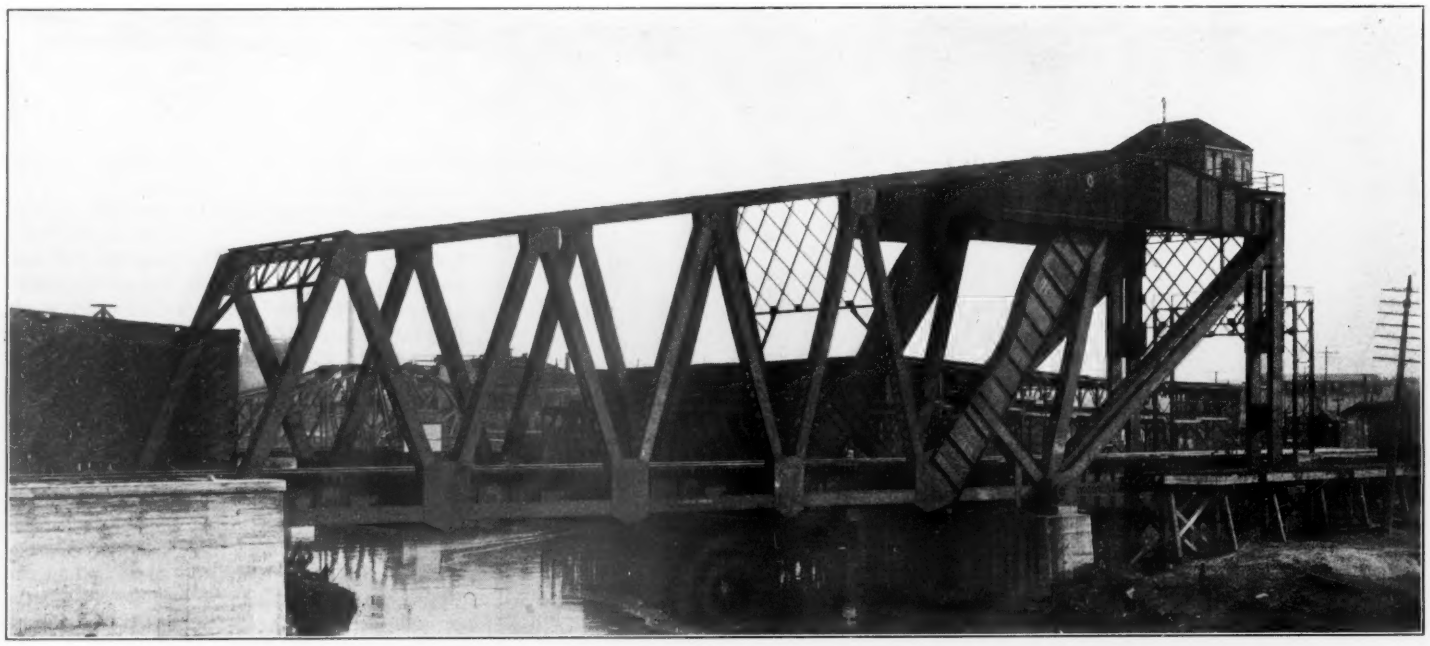


Layout of Heating and Ventilating Apparatus; New York, Ontario & Western Paint Shop at Middletown, N. Y.

Page Single-Leaf Double-Track Bascule Railroad Bridge over the Chicago River.

BY A. R. EKSTROM.
Assistant Engineer, Chicago & Alton.

In connection with certain improvement work being done to the south branch of the South Fork of the Chicago river it was decided early in 1904 by the owning railroads to replace the old swing bridge at Bridgeport with a bridge of the bascule type to give a clear channel of 100 ft. at right angles to the general direction of navigation. After considering several designs of this type it was finally decided to adopt the single-leaf, double-track bridge of the Page design as being the most economical in cost of construction. The bridge was built jointly and is used by the Illinois Central, the Atchison, Topeka & Santa Fe and the Chicago & Alton railroads. It is also used, under rights granted by the Illinois Central, by the Wisconsin Central. The design and erection were done under the supervision of the Chicago & Alton. The bridge crosses the river at an angle of 68 deg. 30 min. and made necessary a leaf of 150 ft. span to give the required clear channel of 100 ft.



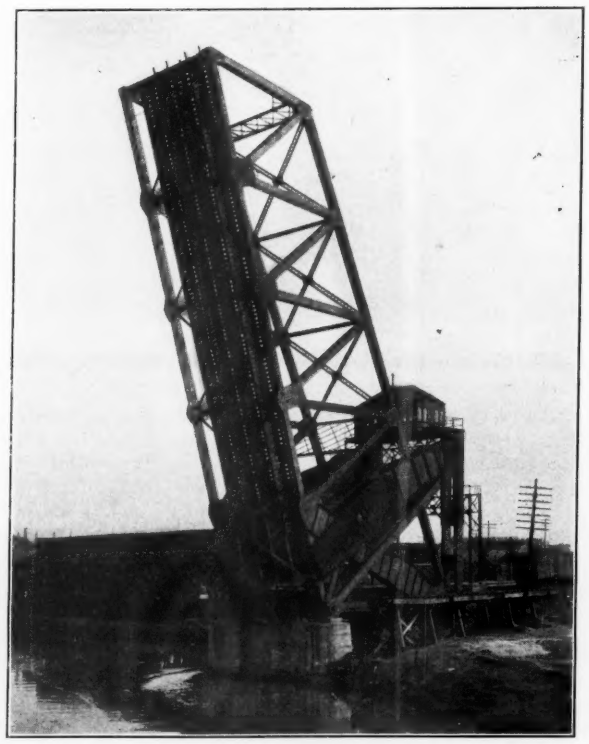
Page Single-Leaf, Double-Track Bascule Railroad Bridge Over the Chicago River.

Work was commenced on the substructure in March, 1905, and was practically completed by the end of December of the same year. The east abutment and the west river pier were located so as not to interfere in any way with maintenance of traffic over the old bridge, the grade and alinement of the new bridge being the same as the old. The east abutment of the new work was located back of the old center pier, while the west river pier was located back of the old pier which supported the end of the swing bridge and deck plate girder approach spans. The east abutment rests on a hard-pan foundation at minus 22½ ft., Chicago city datum, the wing walls of this abutment being connected up to the retaining walls of the track elevation embankment at a point about 53 ft. back from face of abutment.

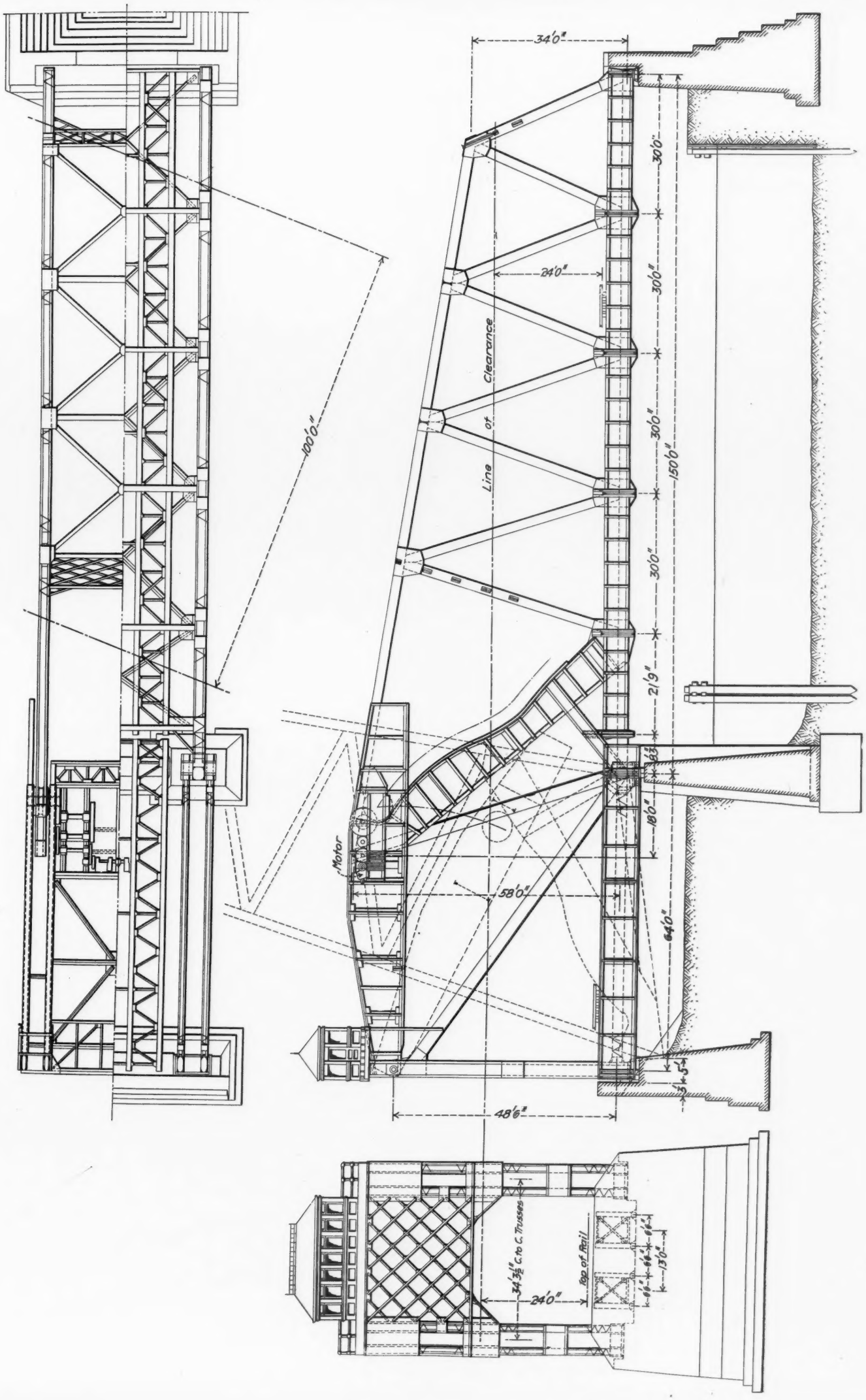
The west-river pier also rests on a hard-pan foundation at minus 27½ ft. Several difficulties were encountered in making excavation for this pier due to water breaking through under the foundation of the old pier, which consisted of grillage resting on piles at about minus 12 ft. After several attempts to stop the leakage it was finally decided to drive Friestedt steel sheet piling inside of the old pier, and after this was done no further difficulties were encountered. The maximum load on the foundation of this pier as designed is about 6,000 lbs. per square foot. Practically no settlement has occurred up to the present time.

The extreme west abutment rests on a hard clay foundation at minus 13½ ft. This abutment, in addition to supporting the embankment, acts as an anchorage to resist the uplift of the superstructure acting as a cantilever under its dead load when in a nearly horizontal position. The substructure, including the wing walls on the east side, comprised a total of about 3,200 cu. yds. The total cost of the new substructure and removal of old substructure, of dredging the channel to a depth of 21 ft. and providing timber protection, was about $50,000.

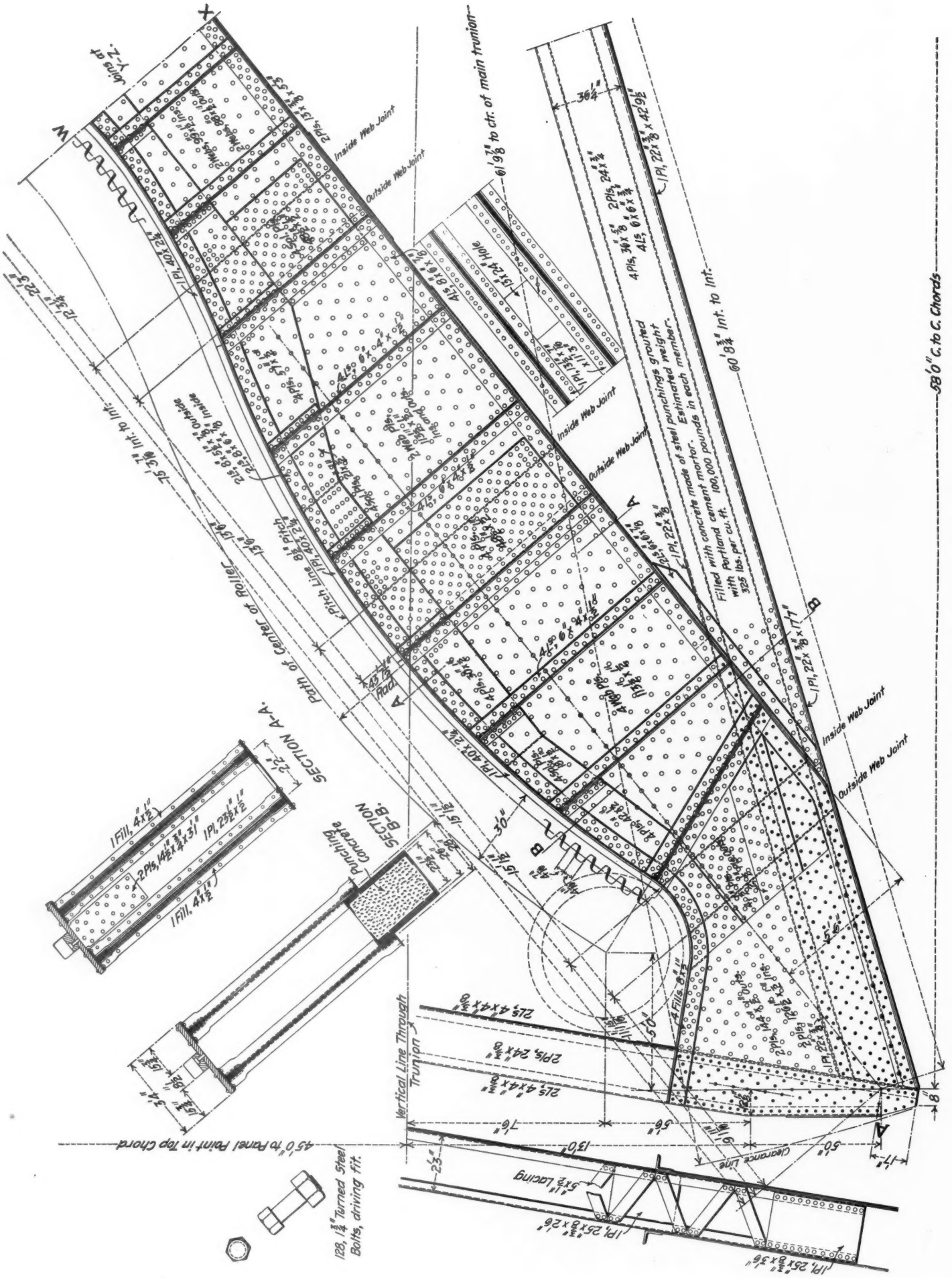
The superstructure consists of a single leaf of 150 ft. with an approach span of 64 ft., and designed to carry on each track a moving load of two locomotives weighing 192½ tons each, followed by 5,000 lbs. per lineal foot. The most important feature of the design is that all movable parts are theoretically in balance during operation, the only power required being that to put the bridge in motion and overcome the effect of wind and friction. The girders carrying the counterweight are hinged each on a pin near the top of the vertical end posts, and the opposite ends of the girders rest on a shaft which carries the load to rollers running on the rack girders. In designing the bridge, the drop of the counterweight girders was made such as to give a clear headroom of 17 ft. for the movement of trains during erection, which necessarily had to be in nearly vertical position. The main driving pinions are keyed to the roller shaft, each being between a pair of rollers, and engaging the rack mounted centrally on the rack girder. To the end of the roller shaft on the inside of the counterweight girder is attached the main driving gear, from which a train of gears leads down to the motor operating the leaf. The gearing and motors are supported on longitudinal girders, these being connected to cross girders which are attached to the inside counterweight girders; the machinery, motors and the girders supporting them thus serve as part of the counterweight. The remainder of the counterweight required on the inside girders consists of concrete placed on buckle plates riveted to the machinery girders. The counterweight on the out-

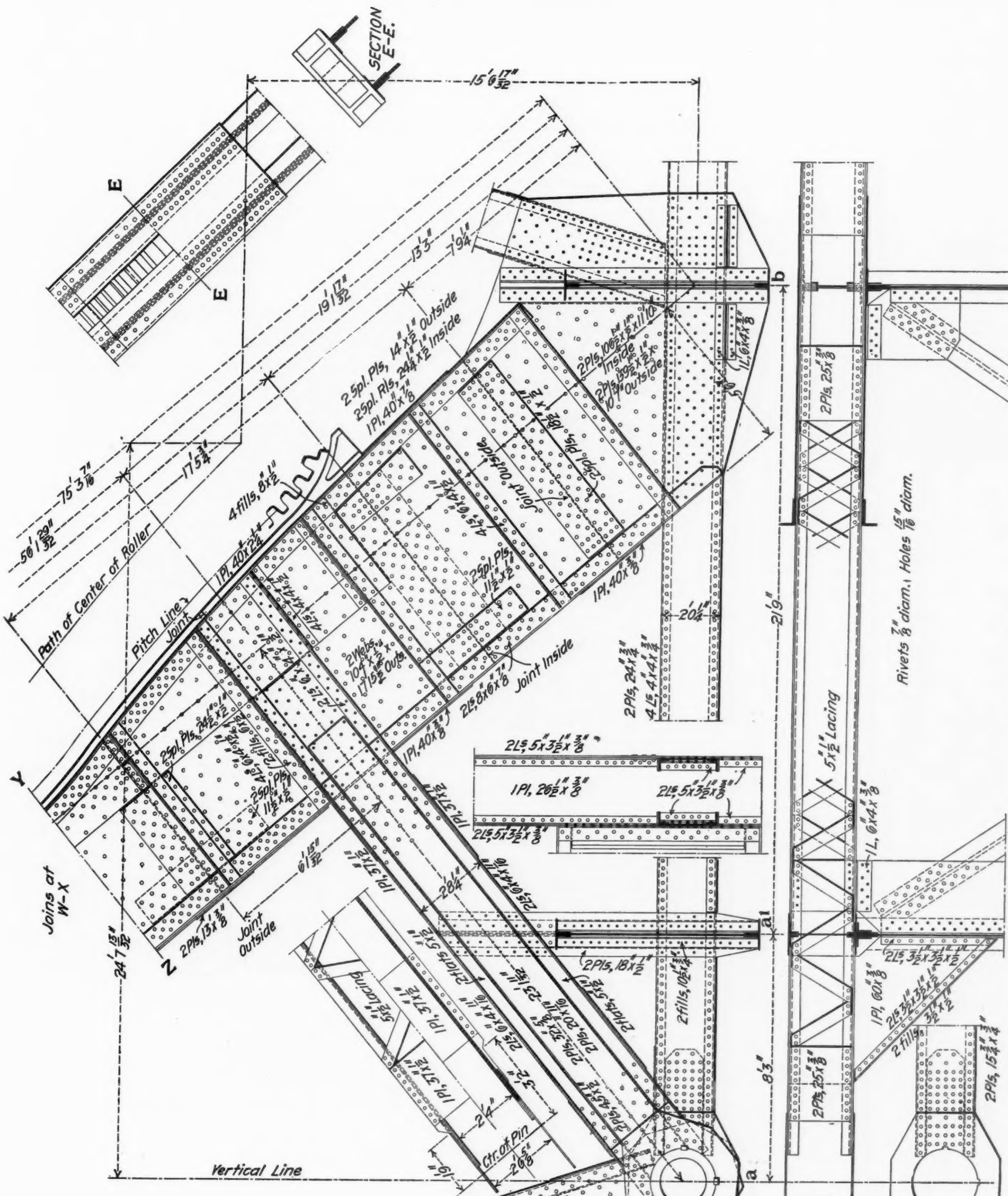


Page Bascule Bridge in Open Position.



Details of Superstructure; Page Bascule Bridge.

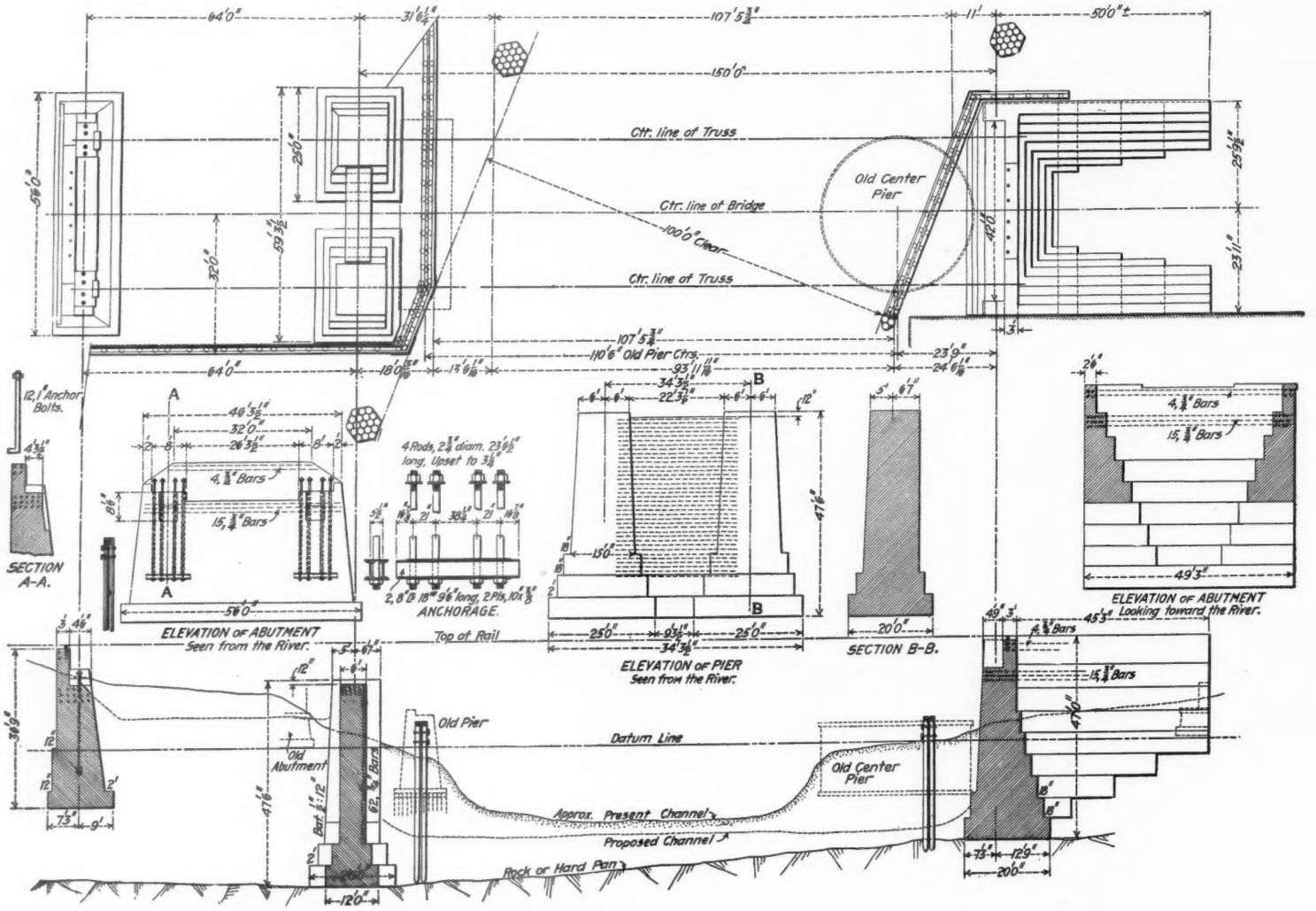

Truss Details; Page Bascule Bridge.
88'0" C. to C. Chords
60'8¾" Int. to Int.
61'9⅞" to ctr. of main trunion
Inside Web Joint
Outside Web Joint
Filled with concrete made of steel punchings grouted with Portland cement mortar. 100,000 pounds in each member. Estimated weight 325 lbs. per cu. ft.
Vertical Line Through Trunion
45'0" to Panel Point in Top Chord
Path of Center of Roller
Clearance Line
128, 1¼" Turned Steel Bolts, driving fit.
SECTION A-A.
SECTION B-B.
Punching Concrete



Truss Details; Page Bascule Bridge.

side girders consists of cast iron blocks bolted to the webs, the blocks so distributed that the load is practically equal on each of the rollers. The bearings for the trunnions, roller shafts, rollers and the rear pins on which the counterweight girders are hinged are phosphor bronze, and all shaft bearings are babbitt metal. The total cost of the superstructure, including the erection and electrical equipment, was about $115,000.

The bridge is moved by two 125 h.p. railway type motors, connected to a series-parallel controller in the main bridge tender's house, which is mounted above the tracks over the vertical end posts. An indicator consisting of a number of electric lamps is placed in view of the tender and shows the position of the bridge in four consecutive positions during the operation, by lighting or extinguishing the different lamps. This is accomplished through a specially designed contact device connected mechanically to the leaf.



Details of Substructure; Page Bascule Bridge.

The operating motors are each provided with a magnetic brake. The brakes are automatically applied at the time of stopping the motors at any point and released when the motors are in operation. The locking of the bridge in place is effected by means of two wedges moving horizontally at the extreme end in the center of the lower chords. These wedges in turn slide under rollers mounted in upright standards that are anchored in the abutment, and in operating tend gradually to draw down and lock the bridge into place. The end lock is operated by a 3-h.p. enclosed type motor near the end and supported on a platform between the stringers under the tracks. The position of the end lock is shown to the tender by an indicator similar in design to that showing the positions of the operating leaf. The switchboard in the tender's house carries the necessary complement of instruments, including circuit-breakers, cut-outs, switches, etc.

While the bridge has been in operation only a comparatively short time, it has been fully demonstrated that the amount of power provided in the motors is more than ample, though some difficulty has been experienced in securing the constant voltage requisite to their satisfactory operation, current being taken from a trolley line nearly a mile distant. Tests made before the machinery and moving parts had time to get smoothed up showed that the bridge requires approximately 70 h.p. to raise or lower, the complete movement, with the motors connected in series, being performed in either direction in about 90 seconds.

Preparatory to putting the new bridge into commission, arrangements were made to detour all trains for a period of 24 hours, though it was confidently expected that 10 hours would be sufficient time. The work of dismantling the old draw span, however, proved so difficult, owing to rusted pin connections with worn false shoulders, that there was actually an interval of 24 hours and 50 minutes before the first train crossed the new structure. Prior to the change the bridge could be operated backward and forward through part of its arc, which enabled the operation to be thoroughly tested before making the change. An all-electric interlocking plant is now being installed for the safe handling of trains.

The bridge was designed by W. M. Hughes, Consulting Bridge Engineer, Chicago, under the Page and Schnable patents. The American Bridge Co., New York, was contractor for the superstructure, the steel work being fabricated at the Lassig plant of that company in Chicago. G. P. Nichols & Bro., Chicago, installed the electrical equipment. The Thomas Phee Co., Chicago, was contractor for the substructure, and the Kelly-Atkinson Construction Co., Chicago, for the erection of the superstructure. The work was carried on under the direction of W. D. Taylor, Chief Engineer of the Chicago & Alton, the writer being in immediate charge of the construction.

Rest Houses on the Baltimore & Ohio.

The first appropriation by a railroad company for the founding of an employees' relief association was made by the Baltimore & Ohio in 1880. This company, too, has been liberal in providing in other ways for the comfort of its employees. Formerly at many of its division points there were poor accommodations or none at all for train crews while waiting over for their return runs. In order that the expense and temptations of public hotels and boarding houses might be avoided by the employees, the Baltimore & Ohio has established at ten different division points—Brunswick and Cumberland, Md.; Keyser, Grafton and Fairmont, W. Va.; New Castle Junction, Pa.; Cleveland, Lorain and Chicago Junction, Ohio, and South Chicago, Ill.—rest houses, where the men can secure good accommodations at no more than the cost to the company. In these rest houses trainmen can get clean and comfortable beds and tub and shower baths for the cost of laundering the linen and towels. There are also libraries with reading matter and games. Restaurants are also run by the company in connection with the rest houses. In order to insure the best of service throughout, the rest houses have recently been placed under the supervision of the superintendent of hotels, who is to manage them as carefully as the hotels open to the public controlled by the Baltimore & Ohio.

Program of the Master Car Builders' Convention, Atlantic City, June 17 to 19.

The sessions of the convention will be held, as was done last year, in the sun parlor near the ocean end of the steel pier. The Marlborough-Blenheim has been selected as headquarters, where the President, Executive Committee and Secretary will have offices. The registration booth will be in the entrance to the steel pier; each member, immediately upon arrival, should report at this booth, register and receive his membership button, if he has none, and be furnished with a properly numbered disc showing his registration. Cards for registration will be furnished at the registration booth. Members will also be furnished with badges for the members of their families. The standard M. C. B. button will be used, but a different disc will be issued. It is therefore necessary that you register. Those members who have attended the convention of the Master Mechanics' Association and expect to remain for the Master Car Builders' convention, should register on the first day of each convention, so that a record may be made of those in attendance at each convention; those who attend but the M. C. B. convention should register but once, and that immediately on arrival.

OPENING SESSION,
MONDAY, JUNE 17, 10:00 a. m. to 1:30 p.m.

Prayer	10:00 a.m. to 10:05 a.m.
Address of President	10:05 a.m. to 10:25 a.m.
Intermission	10:25 a.m. to 10:30 a.m.
To permit visitors to retire, although all are requested to remain.	
Reports of Secretary and Treasurer	10:30 a.m. to 10:45 a.m.
Assessment and announcement of annual dues; appointment of committees on Correspondence, Resolutions, Nominations, Obituaries, etc.	10:45 a.m. to 11:00 a.m.
Election of Auditing Committee	11:00 a.m. to 11:05 a.m.
Unfinished Business	11:05 a.m. to 11:10 a.m.
New Business	11:10 a.m. to 11:25 a.m.
Discussion of Report on: Revision of Standards and Recommended Practice	11:25 a.m. to 12:00 m.
Topical Discussions: Up-to-date Cleaning of Passenger Equipment. To be opened by P. H. Peck	12:00 m. to 12:30 p.m.
Passenger Car Ventilation. To be opened by Wm. McIntosh.	12:30 p.m. to 1:00 p.m.
Discussion of Reports on: Triple Valve Tests	1:00 p.m. to 1:10 p.m.
Brake-shoe Tests	1:10 p.m. to 1:30 p.m.

Adjournment.

MIDDLE SESSION,
TUESDAY, JUNE 18, 9:00 a.m. to 1:30 p.m.

Discussion of Reports on: Tests of M. C. B. Couplers	9:00 a.m. to 9:30 a.m.
Revisions of Rules for Loading Long Materials	9:30 a.m. to 10:00 a.m.
Rules of Interchange, including Report of Arbitration Committee on Revision of Freight and Passenger Car Rules and Prices for Repairs of Steel Cars.	10:00 a.m. to 11:00 a.m.
Cast-iron Wheels.	11:00 a.m. to 12:00 m.
Topical Discussions: Solid Steel Wheels for Passenger Cars	12:00 m. to 12:30 p.m.
Freight Car Repair Shops for Winter Work. To be opened by D. Van Alstyne	12:30 p.m. to 1:00 p.m.
Discussion of Reports on: Arch-Bars for 80,000-lb. capacity Cars	1:00 p.m. to 1:15 p.m.
Air-Brake Hose Specifications; Chemical Analysis of Hose	1:15 p.m. to 1:30 p.m.

Adjournment.

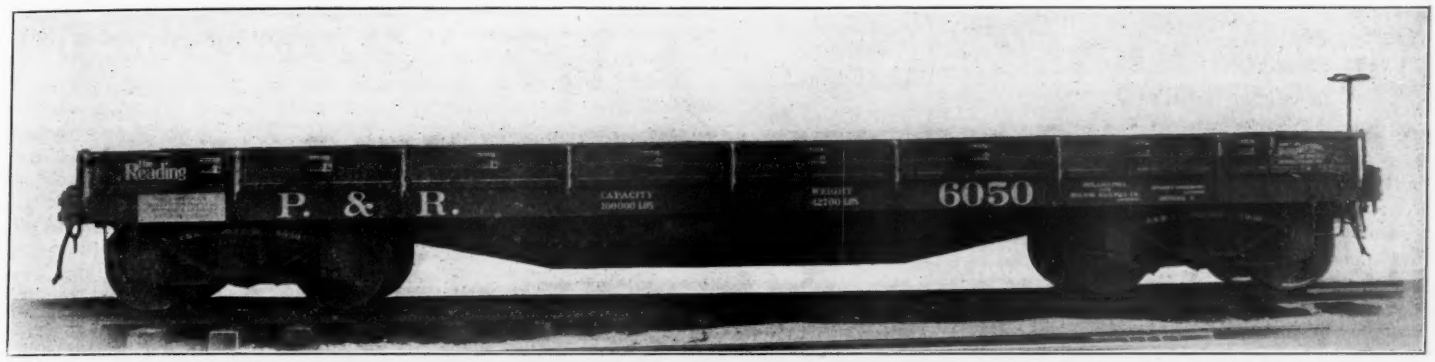
CLOSING SESSION,
WEDNESDAY, JUNE 19, 9:00 a.m. to 1:30 p.m.

Discussion of Reports on: High-Speed Brakes	9:00 a.m. to 9:30 a.m.
Height of Brake Staff	9:30 a.m. to 9:40 a.m.
Automatic Connectors	9:40 a.m. to 9:50 a.m.
Tank Cars	9:50 a.m. to 10:00 a.m.
Stresses to which Wheels for 100,000-lbs. Capacity Cars are Subjected.	10:00 a.m. to 10:30 a.m.
Clearances for Electrical Equipment	10:30 a.m. to 10:45 a.m.
Subjects	10:45 a.m. to 11:00 a.m.
Unfinished Business; Reports of Committees on Correspondence, Resolutions and such other committees as may be named during the convention	11:00 a.m. to 12:00 m.
Topical Discussions: Lateral Coupler Clearances. To be opened by Le-Grand Parish.	12:00 m. to 12:30 p.m.
Truck Springs on Journal Boxes rather than under Bolster. To be opened by F. W. Brazier	12:30 p.m. to 1:00 p.m.
Election of Officers.	1:00 p.m. to 1:30 p.m.

Adjournment.

Low Side Steel Underframe Gondola; Philadelphia & Reading.

The Middletown Car Works, Middletown, Pa., has recently built for the Philadelphia & Reading 400 low side steel underframe gondola cars from designs made in the office of the Superintendent of Motive Power of the road. The cars have a rated capacity of 100,000 lbs., but they have an exceptionally heavy underframe and are capable of sustaining loads much in excess of the normal 10 per cent. overload when required. On this account the light weight is high for this type of car, being 42,700 lbs. The cars are 38 ft. 2½ in. long over end sills, 36 ft. 4¼ in. long inside and 8 ft. 9¼ in. wide inside. They have wooden plank floor and sides 12 in. high, but the ends are formed of 12-in. channels, hinged to drop down when required. The underframe is built up entirely of structural steel, the end sills and side sills being respectively 12-in., 25-lb. and 10-in., 30-lb. channels. The center sills are built up girders to which the 12-in. channel draft sills are spliced in front of the bolster. The center sills are 30 deep at the center and are built up of ⅜-in. web plates, a 20-in. x ¼-in. top cover plate, a single 4-in. x 5-in. top flange angle, and two 4-in. x 5-in. bottom flange angles. The side sills transmit their load through three girder cross bearers between the bolsters, in addition to which they are stiffened with eight channel cross braces which support the floor nailing strips. The side planks are supported by pressed steel stakes riveted to the side sills and the stake pockets for temporary stakes are bolted to the planks instead of the sills.



50-Ton Low Side Steel Underframe Gondola; Philadelphia & Reading.

The Cost of Freight Car Repairs.

BY M. K. BARNUM.

For the last few years the cost of freight car repairs has been increasing at the rate of approximately 10 per cent. a year, or about $5 a car, on many of the large railroads. On some roads the increase in cost of repairs per car has, to a certain extent, been due to nursing the old cars to an ultimate age of from 20 to 25 years, but even those roads which have adopted the steel car as standard, and have dismantled cars only 12 or 15 years old, have found repairs steadily mounting upward. These increases might be satisfactorily accounted for in full by the advance in wages and cost of material, but as they began to be conspicuous two or three years ago, while the most important advances in the cost of labor and material are more recent, there must be other contributory causes which are not so easy to determine.

The lack of accurate data has made it difficult and often impossible for car department officers to explain this steady increase in the cost of repairs. It has not been customary for railroads generally to keep a separate account of repairs to each car by number, or, as a rule, to certain classes of cars, the usual practice being to charge all labor and material to a general freight car repair account. Because of this practice, there is little accurate information as to the actual or proportionate cost of repairs to the various parts of freight cars, such as roofs, doors, draft gear, drawbars, truck frames, etc. One western road has compiled figures for the fiscal year 1906 which distribute the repairs to freight cars somewhat roughly under a few heads as follows:

Items.	Per cent. Material.	Labor.	Total.
Wheels and axles	15.0	1.6	16.6
Remainder of trucks	9.2	3.3	12.5
Draft gear	12.2	7.2	19.4
Sills and underframing	6.1	3.4	9.5
Superstructure	15.9	9.8	25.7
Couplers	8.1	2.5	10.6
Doors, side and end	1.6	1.0	2.6
Doors, grain	0.6	0.6	1.2
Roofs	1.2	0.7	1.9
Total	69.9	30.1	100.0

Average number of times each car was repaired, 5.5.

This distribution of expense has not been made in sufficient detail to be of much value to car department officers in determining those parts of the car which are most in need of improvement and in which there is the greatest possibility of reducing the cost of

Another western road has had in effect for the past year a

system of distributing the cost of repairs to locomotives and passenger cars among the most important parts which has been found satisfactory and a committee is now working up the details of a similar plan for distributing the cost of freight car repairs. This committee is composed of representatives from the car shops, the supply and auditing departments, and from the mechanical engineer's, superintendent of motive power's and executive offices. After numerous meetings and a careful consideration of every part of a freight car, it has been decided to divide and classify the cost of repairs to each car under the following heads:

(Form "A.")

A., B. & C. RAILWAY COMPANY.

Freight Car Repair Report.

Car Initial..... No..... Kind..... Capacity..... Length.....
.....Shops, ...190....

Description of Repairs.	Cost of Repairs. Labor.	Material.	Total.
I. TRUCK:			
No... Kind... Removed... Applied...			
1. Wheels and axles			
2. Journal box and box bolts			
Kind..... Removed..... Applied.....			
3. Arch and tie bars			
4. Steel side frames			
Kind..... Removed..... Applied.....			
5. Column and column bolts			
6. Barber roller device			
7. Bolster .. Kind.. Removed... Applied..			
8. Brake hanger brackets			
9. Other truck parts			
II. DRAFT RIGGING:			
Kind..... Removed..... Applied.....			
1. Couplers.. Name.. Removed.. Applied..			
2. Yoke rivets			
3. Draft timbers			
4. Draft lugs			
5. Other draft rigging parts			
III. UNDERFRAME..... Kind			
1. Body Bolsters.... Name and Kind..... Removed..... Applied			
2. Center sills.. Kind.. New or Spliced...			
3. End sills			
4. Center and end sills in combination....			
5. Other underframe parts			
IV. SUPERSTRUCTURE:			
1. End posts			
Kind..... Removed..... Applied.....			
2. Ends (including side plates in combination)			
3. Lining			
4. Doors and fixtures (roofed cars)			
5. Doors, fixtures and operating mechanism (open cars)			
6. Other superstructure parts			
V. ROOF:			
Kind..... Removed..... Applied.....			
1. Upper course			
2. Lower course			
3. Framing			
4. Running board and fixtures			
VI. PAINTING AND LETTERING			
VII. BRAKES: Kind..... {Inside / Outside}			
1. Brake Company's parts			
2. Brake-beams, Name and kind..... Removed..... Applied			
3. Other brake parts			
Grand total			

Remarks:.....
.....
.....
.....

Most railroads have at some time tried to obtain the cost of repairs to certain parts of cars such as wheels, journal bearings, couplers, etc., but, so far as we know, none have yet attempted to distribute the total cost of repairs among the more important parts of the car, as in the plan just outlined. It is estimated that the cost of keeping these records for a road owning about 50,000 freight cars, in sufficient detail to obtain all desired information, will be about $1,000 a month; also it is believed that after these records are kept for six months or a year sufficient information will be obtained to serve all present practical purposes, so that the record may be suspended until such time as a change in design of the cars or in other conditions makes it desirable to obtained revised data.

The benefits to be derived from this information are: (1) An analyzed record of expenditures will greatly facilitate keeping down the cost of repairs; (2) figures showing definitely the amount spent for maintaining the separate parts of freight cars will enable the railroads to determine pretty closely the possible savings to be effected and how much they can afford to pay for improved or patented designs. In short, it is believed that this plan will furnish the prime requisite towards keeping down or reducing the cost of repairs, namely, accurate knowledge as to how and where the expenditures are applied.

School of Railway Engineering and Administration of the University of Illinois.

In noticing in our issue of March 22 a pamphlet sent out by the University of Illinois about its school of Railway Engineering and Administration, it was stated that a bulletin containing full detailed information regarding these courses would soon be issued. This bulletin has just been issued. It is a 60-page book and gives the information about the four courses comprised in this particular school with all of the detail and fullness of the usual college catalogue.

Four railroad courses are offered: civil engineering, electrical engineering, mechanical engineering and administration. The main object of these courses is to provide a thorough training in theory and general principles, amply illustrated and fixed by practice. The civil and mechanical engineering courses are intended to fit the student for the construction and maintenance of way, and the motive power departments respectively. The electrical course is for service on electric railways or steam roads having electrified lines. These engineering courses differ but slightly, if at all, from the regular university courses under these headings until the last year is reached. The administration course, which is also four years in length, has been specially framed throughout to give wide knowledge and training in the specific matters which relate to the organization and operation of all departments of railroad administration and at the same time give the student a liberal education.

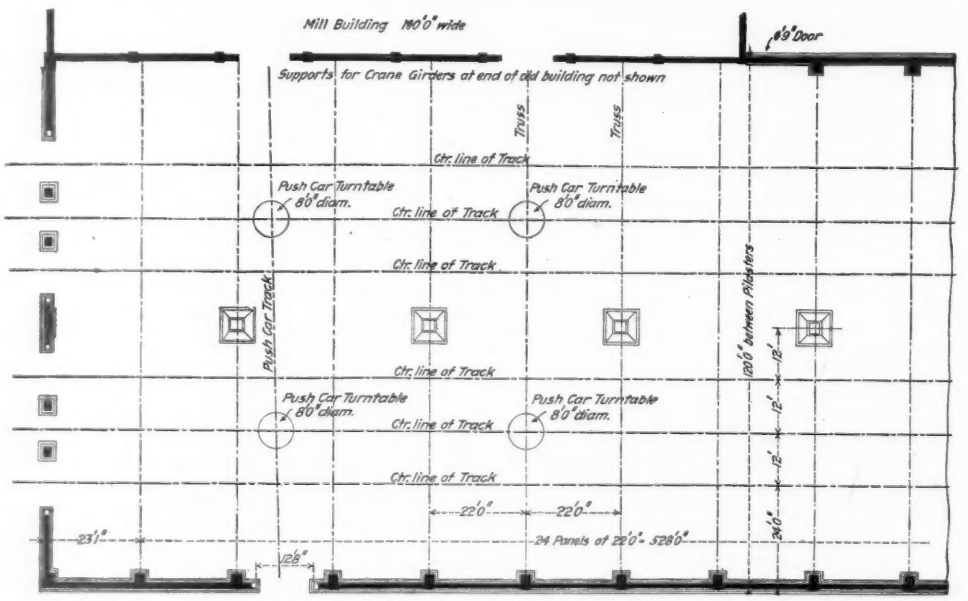
The instruction corps for all phases of the work in this newly-formed railroad engineering department has been selected, with one important exception, namely, the head of the department. The man selected for this position will have general charge of all the engineering work and therefore should preferably be one who has had experience in the maintenance of way department and can give instruction in railroad civil engineering. Efforts are now being made to find a suitable man for this vacancy.

Recent Shop Construction.

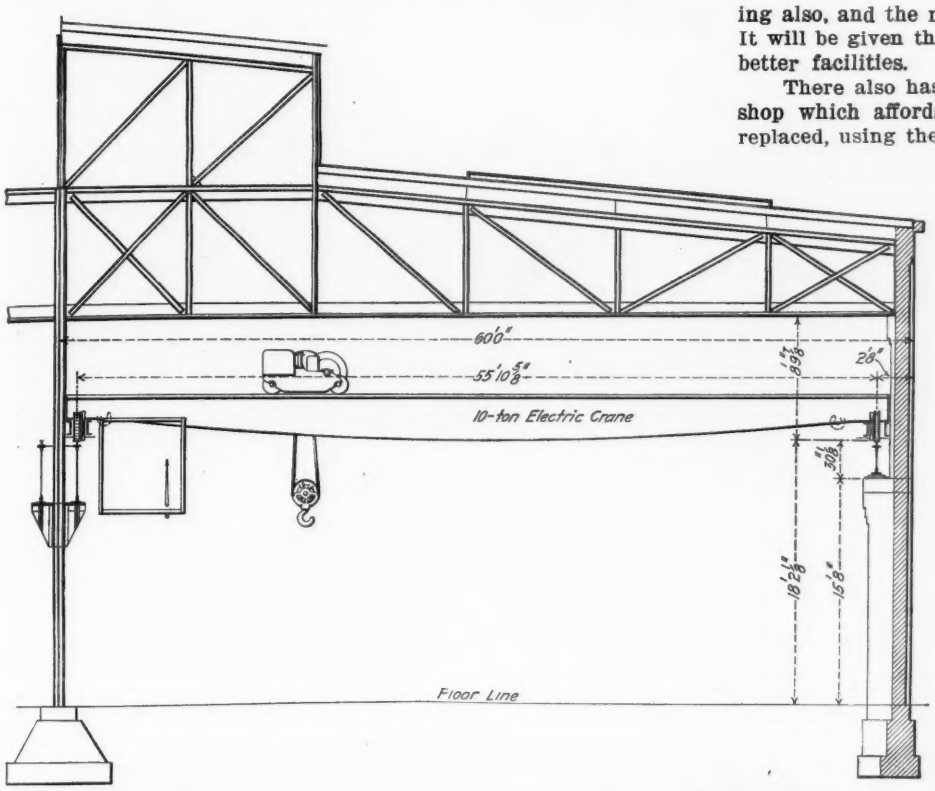
BURNSIDE SHOPS OF THE ILLINOIS CENTRAL.

The Illinois Central has recently completed at its Burnside shops, Chicago, a new freight car shop which enlarges the plant's capacity for work of this character by 130 per cent. The old freight car shop is 502 ft. long and 100 ft. wide, with track room for 40 cars. The new building is 574 ft. long by 120 ft. wide and has space for 52 cars. It was planned to handle the work through it as expeditiously as possible.

A part plan and cross-section of the building are shown herewith. Its long dimension is east and west and it is built on to the north end of the mill building, lying at right angles to it, the east walls of the buildings being flush and the two therefore forming an L in plan. The new building has steel columns and roof trusses and brick walls. It is in two bays of equal width, each containing three tracks, the central one of which is a material track. There are two push-car turntables in each of these tracks at both ends of the building. Each bay is served by a 10-ton electric traveling crane running the full length of the building. These cranes are capable of lifting car bodies off the trucks and depositing them at any desired point in the shop. Because of the crane service the usual style of platform for the men to work on the upper parts of box cars cannot be installed and there is now being built a special



Part Plan of Burnside Freight Car Shop, Showing Track Arrangement.



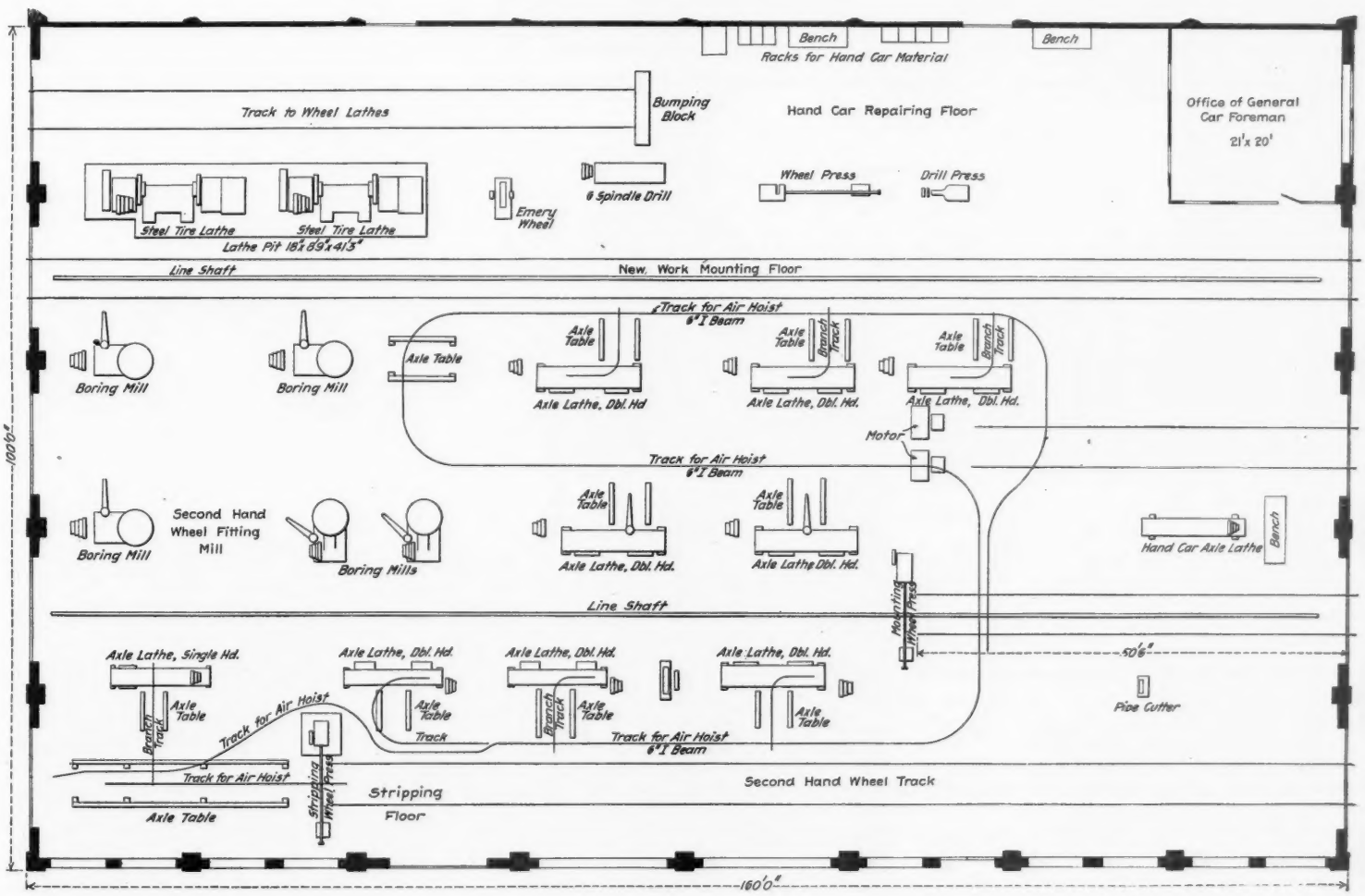
Half Cross-Section of Burnside Freight Car Shop; Illinois Central.

design of portable platform which the cranes will move from point to point as they are needed. Each track has its individual compressed air line, with hydrants on or opposite the roof-supporting columns. The building is heated by the hot blast system, overhead distribution. The artificial lighting is by Cooper-Hewitt mercury vapor lamps swung to the lower chord of the roof truss, there being 25 in the shop.

Besides the large amount of repair work, the Burnside shops build all equipment for replacement. The older freight car shop was altogether inadequate to handle the heavy repairs and do the building also, and the new shop will therefore afford much-needed relief. It will be given the preference in new construction work because of better facilities.

There also has been completed lately at Burnside a new wheel shop which affords a 30 per cent. greater output than the one it replaced, using the same size force and the same machinery, except that there is a reduction in the quantity of same. This result is due to laying out the shop and handling the work through it in such manner as to minimize lost motion and the interference of one movement with another. The arrangement and controlling conditions of the old shop were admittedly bad, also its location was unfavorable. It was too far removed from the car shops, being at the south end of the machine shop, about 1,200 ft. from its present location, which may be considered the logical one. There was only one large door through which everything had to come and go. The result was a continual congestion and inability to furnish wheels and axles as fast as needed.

A plan of the present shop is here reproduced. It forms an extension to the north end of the passenger car repair shop, with the new freight car shop directly west of it and the old freight car shop immediately north. The second-hand wheel storage yard is just north of the new freight car shop. The wheel shop thus occupies a central point in the car section of the plant. Second-hand wheels and axles are brought into the building through the door at the northwest corner, where there is a storage track leading to the stripping floor and wheel press at the east end of the building, affording room for a large number of wheels and axles. This is a convenient feature, particularly in the winter time, avoiding frequent opening of the door to admit a fresh supply. As the plan indicates, the scrap wheels are taken through an adjacent door in the north wall of the building where they are loaded into cars standing on a depressed track just outside. The axles are rolled onto a table back of the press, whence they are carried to the axle lathes by the air hoist trolley. New wheels and axles are stored outside of the east end of the building and move west past boring mills and axle lathes to the mounting wheel press, beyond which

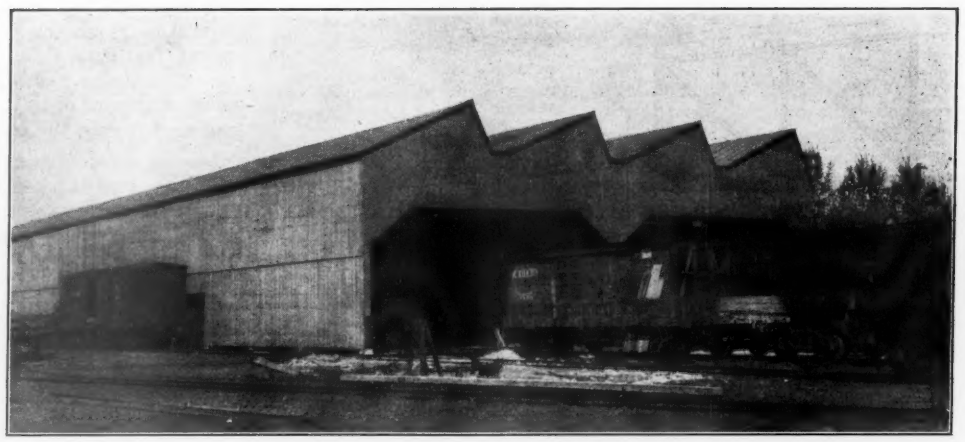


Wheel Shop of the Illinois Central at Burnside.

is a storage track for 25 pairs of wheels leading out to the yard distributing tracks.

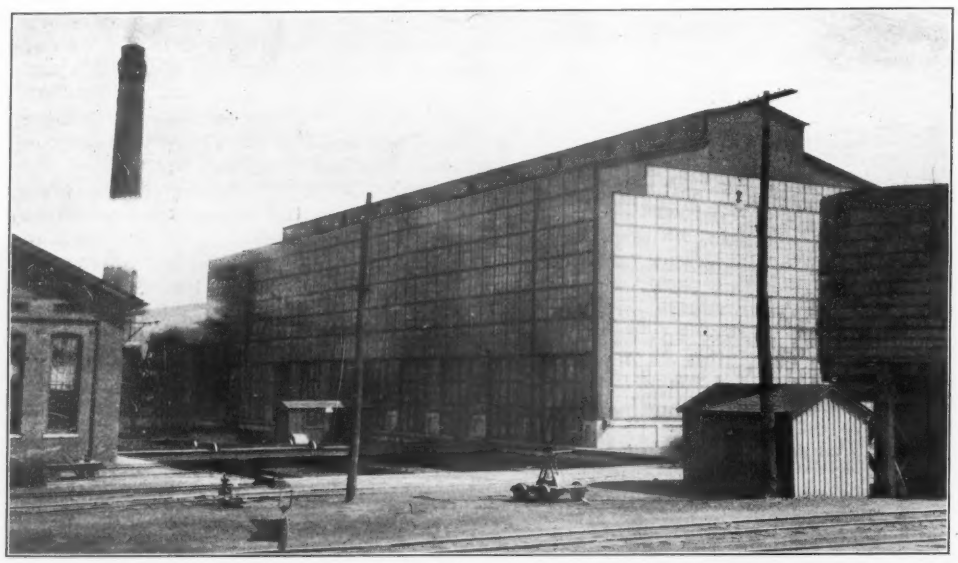
The steel-tired wheel section is in the southeast corner of the shop. The wheels and axles are stored on a track back of the two tire-turning lathes. The latter are depressed 18 in. for convenience of placing and removing the work. In front of the lathes, running through the shop, is a track for mounting new work and running the re-turned wheels out of the shop. The southwest corner of the shop is used for hand car work.

This shop has one axle lathe and two wheel presses less than its predecessor, yet because of its arrangement, location, and the freedom with which business is handled through it, it is able to turn out 30 per cent. more work, and easily keeps ahead of the demand for wheels and axles.



Car Repair Shed with Saw-Tooth Roof; Princeton, Ind.

Another feature of the car work deserves mention. All passenger cars coming in for overhauling are first run into a stripping and scrubbing room lying between the passenger paint shop and the upholstery room, and having space for four cars. Here the cars are stripped of upholstery, windows, brass work, etc., the departments for which immediately adjoin this room. The car is then thoroughly washed and sent to the repair shop. This separate room for this work has proven a great convenience, as it avoids all interference with the other car work. At one end of the room is a bench for repairing injured or broken sash before passing them into the varnish room.



Erecting Shop; Princeton, Ind.

The method of cleaning the plush of seat cushions, etc., here used is simple and effective. After blowing out the dust as well as possible with an air blast, the surface is gone over with a brush dipped into a warm very weak solution of ammonia. It is then subjected to the air blast a second time, which blows out practically all of the moisture and with it all remaining dust, restoring the plush to its original brightness. The method is much more satisfactory than the use of a cleaning soap, which cannot be entirely removed from the plush and in time stiffens and hardens it.

PRINCETON SHOPS OF THE SOUTHERN.

The principal repair point of the St. Louis-Louisville lines of the Southern is Princeton, Ind. The facilities here have lately been increased by a number of important additions, most notable of which is a new erecting shop. A photographic view of this building is given herewith, and shows it to be unique for a building of this character, the sides and ends being entirely enclosed with glass.

The building adjoins the old machine shop, one wall of which was removed to consolidate the two. The erecting shop is 220 ft. x 76 ft. outside. The framework is entirely of steel. The bents are spaced 20 ft. centers. There are no intermediate supports for the roof, the trusses, which are riveted steel, one-third pitch, having a clear span of 74 ft. A clear-story runs the entire length of the roof. A noticeable feature of the steel framework is the absence of unsightly wind bracing, all bracing being by means of gussets at the top and bottom of the posts. The crane girder, 45 in. deep, is bracketed to the posts, and runs the length of the building. The crane, which has an ultimate capacity of 140 tons, has developed 120 tons in a working test.

The glass in the sides of the building extends from the top of the concrete wall, which reaches 5 ft. above the floor, to the roof line and is composed of 12 in. x 18 in. lights of ribbed glass, which prevent all glare and diffuse the direct rays of the sun. The lighting is a special feature of the building and has proven highly satisfactory.

In each 20 ft. panel of the building is a 50 ft. concrete engine pit, or ten in all. Between these pits are large pits for the storage of "o. k." materials stripped from engines on the repair pits. The storage pits are covered with heavy oak doors, fitted flush with the floor, and provided with rings to enable them to be hauled by the crane. The floor of the shop is Portland cement concrete. The building is heated with steam radiators secured to the posts and extending from the floor to a height of 20 ft. There are also steam coils in each repair pit.

Locomotives enter and leave the building over an electric transfer table of 150 tons capacity, 75 ft. long. It runs on five rails and has a working speed of 150 f. p. m. The equipment of the shop is electric driven and strictly up-to-date.

The Princeton improvements include a new coaling station and dry sand supply house. The coal plant is a gravity dumping, bulk storage system of 400 tons capacity. There are 12 coal pockets on each side of the chute. These pockets are of three sizes, there

Interior View of Erecting Shop; Princeton, Ind.

being 12 six-ton pockets, six 7 ton and six 8 ton pockets. The coal passes from the storage bin into each pocket through an undercut retaining gate worked by hand from the inside of the chute. The Williams-White pattern of apron and exterior retaining door is used. Loads are moved up the incline by a motor-driven Lidgerwood hoist, carrying 600 ft. of cable. The coal is deposited in the storage bin from hopper-bottom cars. On the rear of the coal chute, forming a part of that structure, is the sand house having a sand storage bin of ten cars capacity, two dry-sand pockets of 4 yds. capacity each, and a steam sand dryer. The sand storage bin is under the track, enabling the sand cars to dump directly into same. The dryer is above the sand pockets, likewise affording a gravity run for the dried sand. The gradient of the station incline is 20 per cent., decreasing to 10 per cent. on the final, or top, panel. This plant has effected a material saving in the handling of sand and coal at this point and assures prompt service to the locomotives.

A view of the new freight car repair shed is also shown. It has a saw-tooth roof and the lighting of the interior is said to be altogether satisfactory. The building, which is wood throughout, is 261 ft. long and 80 ft. wide. It contains four freight car repair tracks and two tram or material tracks. The roof is carried on wooden Howe trusses of 40 ft. span, the building being divided into two bays.

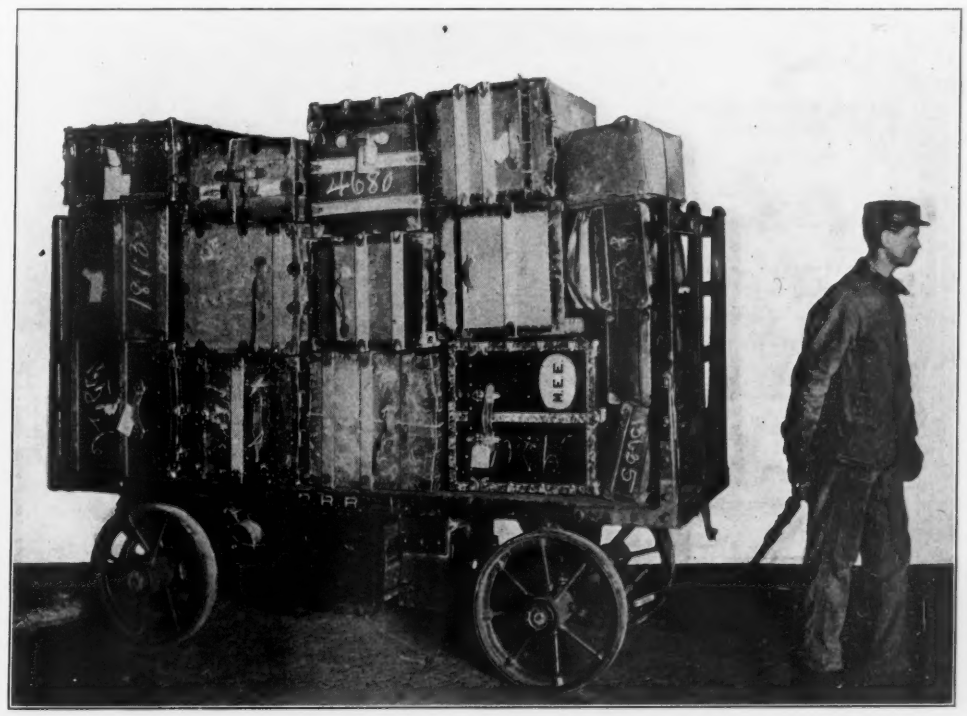
We are indebted for data to Mr. Edward Gray, Engineer Maintenance of Way of the St. Louis-Louisville lines of the Southern, who had charge of the work.

Electric Baggage Trucks.

The Pennsylvania Railroad has recently built three electrically propelled trucks for carrying baggage and mail between trains, and the baggage and mail rooms in stations. Two are in service in the Broad street station, Philadelphia, and the third at Altoona. Although similar in general appearance, the three trucks differ in many essential details. They are still in the experimental state, and careful records are being kept to determine which type is the best for general use. The type of truck which has been found to be most serviceable up to the present time is similar to the hand drawn type in common use. It is operated by one man, who walks ahead of it and steers the front wheels with a tongue or handle. Power is taken from a storage battery carried in a box secured to the under side of the platform. It consists of 14 Willard cells and has a capacity of 136 ampere hours. The batteries are charged about eight hours daily at the rate of 17 amperes.

Each of the rear wheels is driven by a Westinghouse type AA, 4-pole, series wound, 20-volt motor. Double reduction gearing is used between the motor and rear wheel, and each motor is provided with a solenoid brake of the multiple disc type on the end of its shaft. These brakes are essential for safe operation, for the truck cannot start itself even on an incline, and if in motion it stops promptly and automatically as soon as the power is shut off. Only two speeds forward and two backward are provided. These are approximately 4 and 6 miles per hour for the loaded truck, and on the crowded platforms they have been found fast enough.

The two motors are operated in series and on the low speed a wire resistance is inserted. The motor current is controlled by two single pole solenoid switches, one for the low and the other for the high speed. The solenoid switches are enclosed in a box in front of the storage batteries, and current for operating them is controlled by contacts in a small box on the outer end of the tongue or handle. The contact box is of metal, cylindrical in form, and operated by a rod which slides axially through it. The rod is provided at one end with a ring, which is grasped by the operator. A slight movement of the rod starts the truck forward at low speed; further movement of the rod gives the high speed. The rod is returned to the off position by a spring so that when the ring is released the truck stops. It cannot be started by any accidental knock, but only by an intentional pull on the ring. The pole changing switch for running the truck backward or forward, is located in the box with the solenoid switches and operated by a small lever under the front of the platform. The tongue or handle is connected by reach rods to pivoted bell cranks carrying the two front wheels in a way similar to that generally used upon automobiles. This truck has been in successful operation about six months. One man can handle heavy loads of baggage and mail quickly and easily.



Electric Baggage Truck; Pennsylvania Railroad.

Proposed Rules to Prevent Diversion of Cars.

The Car Service Committee of the Association of Transportation and Car Accounting Officers has prepared the following rules to define and prevent diversion of freight cars. These rules are based on a recommendation of the committee made at New Orleans in November, 1906, and also on rules presented to a special committee of the American Railway Association on April 22, 1907. The amendment rules finally prepared are as follows:

Whereas, The Car Service Rules are not observed in present practice; therefore be it

Resolved, That we recommend to the Committee on Car Service of the American Railway Association that rules governing the handling of cars be incorporated in the Code of Per Diem Rules and be made a part of the Per Diem Rules Agreement; and be it further

Resolved, That we recommend to the Committee on Car Service of the American Railway Association the principles embodied in the following declaration and rules, to wit:

That the owner has a right to demand that his cars shall be kept moving in a homeward direction.

That the marks of ownership on a car are a sufficient guide to insure its movement toward the owning road.

That the intent of these rules is to make railroads responsible for keeping foreign cars moving toward the home road and to prohibit them from sending a foreign car in an opposite direction if in serviceable condition, except as hereinafter provided for.

Cars will be furnished to *shippers* for loading, under the following regulations:

1. Shippers will file a written order on a prescribed form with the agent at the station where cars are to be loaded, specifying the kind and number of cars wanted, commodity to be shipped, destination, when required and routing.

2. Agents will keep suitable record of orders for cars and of cars furnished, and will notify shipper in accordance therewith.

3. Shippers will be held responsible for loading cars contrary to the assignment made by the agent: For failure to properly load, the railroad may demand that the shipper unload or transfer cars at his expense, and car service charges at the current rate will apply against the load for each day car is held awaiting transfer or unloading, no free time to be allowed.

Foreign cars must be handled as provided for in one or more of the following sections:

WHEN LOADED.

4. Cars owned by *immediate* connections must be returned direct to owners or loaded via any route so that the home road will participate in the freight rate.

5. Cars owned by roads not immediate connections may be loaded to the road from which originally received if such loading is in the direction of the home road, *but not otherwise.*

6. Cars owned by roads not immediate connections may be loaded to an intermediate road in the direction of the home road or

loaded via any route so that the home road will participate in the freight rate.

[NOTE.—A road or combination of roads connecting with the road owning the car from point of delivery to destination shall not be considered as an intermediate road or roads.]

7. Loaded in local service in the direction of home route junction point or to any junction point with the home road: All movements to be in the same direction.

8. Cars may be loaded locally in an opposite direction from the home road or home route, if to be loaded according to rules 4, 5 or 6.

9. Loaded cars may be reconsigned or delivered to connecting roads only for movement within the switching limit.

10. The reconsignment of a loaded car, except as provided for in Rule 9, stands in the same attitude as the use of a car for a new load.

WHEN EMPTY.

11. The car owner shall have the right to demand the return of his empty cars at the junction point where delivered loaded.

12. Empty cars belonging to a system having a direct connection must, unless the owner objects [see Rule 11], be returned to such connection regardless of whence they came.

13. Empty cars may be sent in an opposite direction from the home road or home route, if to be loaded according to rules 4, 5 or 6.

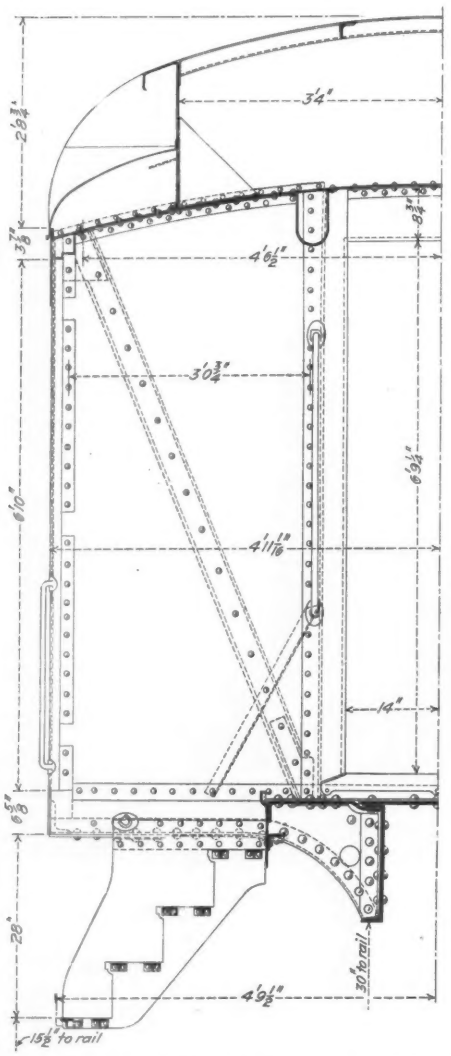
14. Empty cars may be delivered to connecting road switching or otherwise, to be loaded in accordance with rules 4, 5 or 6, *but not otherwise.*

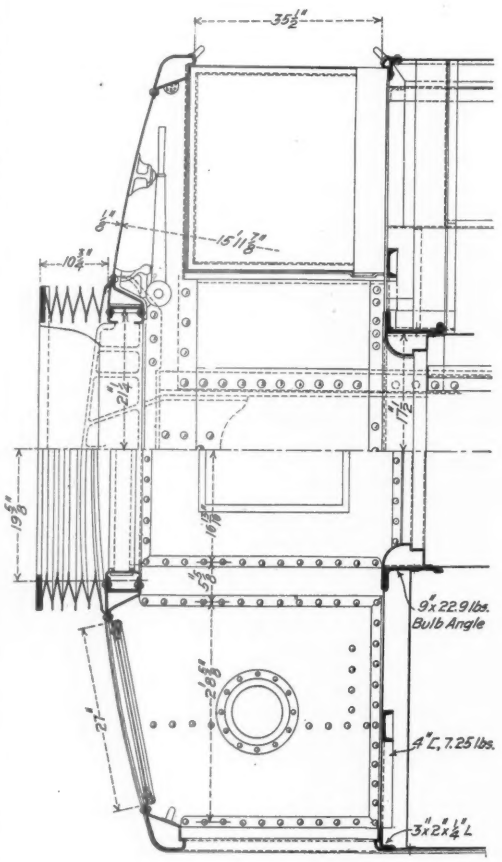
15. When necessary to return cars empty belonging to roads other than direct connections, they may be delivered via home route junction to the road from which originally received.

16. If a road has an empty car that cannot be disposed of according to the foregoing it must be reported to the owner and disposition arranged for.

WHEN IN SWITCHING SERVICE.

17. Cars received loaded in switching service must be confined to switching territory, and when made empty must be returned to the owner, if a direct connection within that territory, otherwise to the road from which received.





Plan and End Elevation of Vestibule Framing; Pennsylvania Steel Cars.

Steel Passenger Cars for the Pennsylvania Railroad.

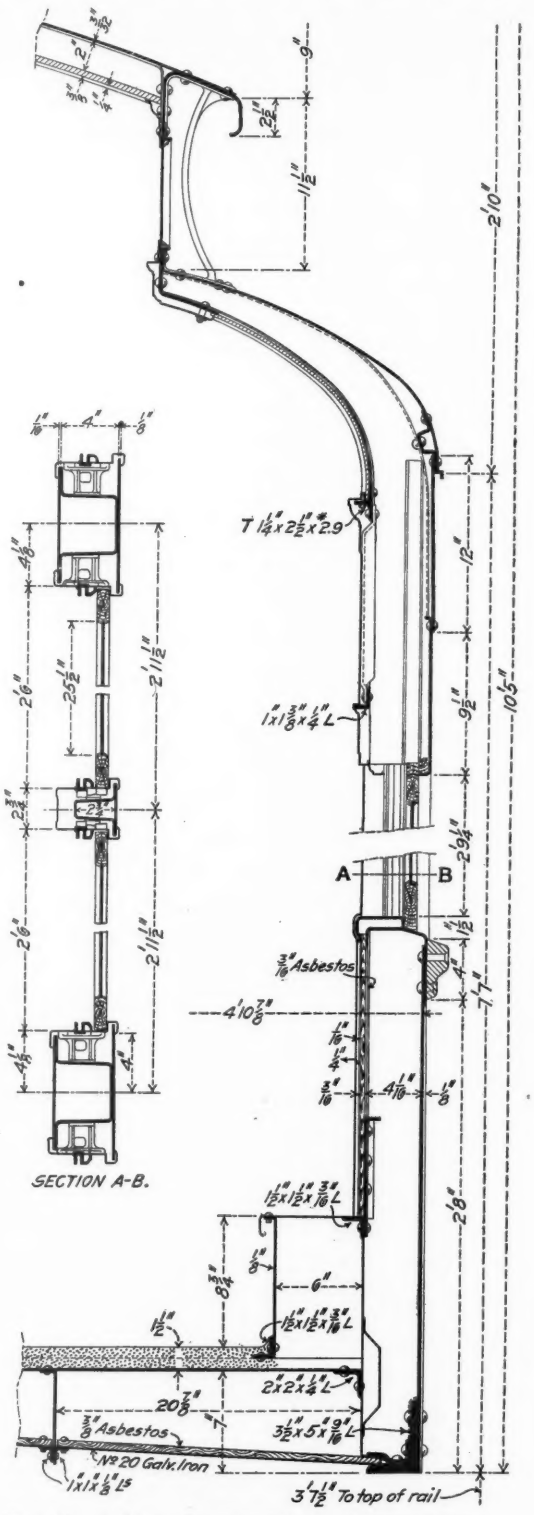
The Pennsylvania Railroad has ordered the construction this year of 200 all-steel passenger cars, which is the largest order yet given for this class of equipment. This is the result of a long period of inquiry and experiment, in which the late President Cassatt took an active part. After several cars had been built the President appointed a committee of motive power officers to make a thorough report on the design to be adopted and the orders placed are in accordance with the recommendations of that committee.

Two general types of steel passenger equipment have been adopted: For through trains; drawn by steam or electric locomotives and composed of mail, baggage, sleeping, dining or day coaches; a long car of heavy construction suited to withstand the strains incident to pulling, coupling or buffing long trains.

For suburban trains; drawn by a locomotive or propelled by motors upon the truck axles; a short car of lighter construction suited to operation in frequent short trains to accommodate the traffic.

The heavy equipment will be composed of cars of the following general dimensions:

Passenger Coach—70 ft. 5¾ in. long over body, estimated weight



Detail of Side Construction; Heavy Type Steel Car.

113,500 lbs., four-wheel trucks, and two closets, seating 88 passengers.

Mail Car—71 ft. 4⅜ in. long over body, weight 128,000 lbs., provided with universal or interchangeable interior arrangement and six-wheel trucks.

Baggage and Express Car—60 ft. 10⅜ in. long over body, weight 91,000 lbs., capacity 40,000 lbs., four-wheel trucks.

Special Baggage and Express Car—Baggage and mail compartment, or horse express cars; 70 ft. long over body, approximate weight 120,000 lbs., capacity 60,000 lbs., six-wheel trucks.

Passenger-Baggage Combined Car—71 ft. 1 in. over body, approximate weight 130,000 lbs., six-wheel trucks, one closet and one lavatory.

Dining Car—71 ft. 11¾ in. over body, approximate weight 140,000 lbs., six-wheel trucks, table capacity to serve 30 passengers.

The suburban, or light equipment, will include cars of the following general dimensions:

Passenger Coach—54 ft. 4 in. long over body, approximate weight 75,000 lbs., seating about 70 passengers, four-wheel trucks; height from top of rail to underside of frame 41 in., to admit application of electric motors; total height of car above rails 13 ft., to permit installation of overhead trolley; vestibule doors for both high and low platforms.

Passenger-Baggage Combined Cars—Mail compartment and baggage cars of the same general dimensions as passenger coach.

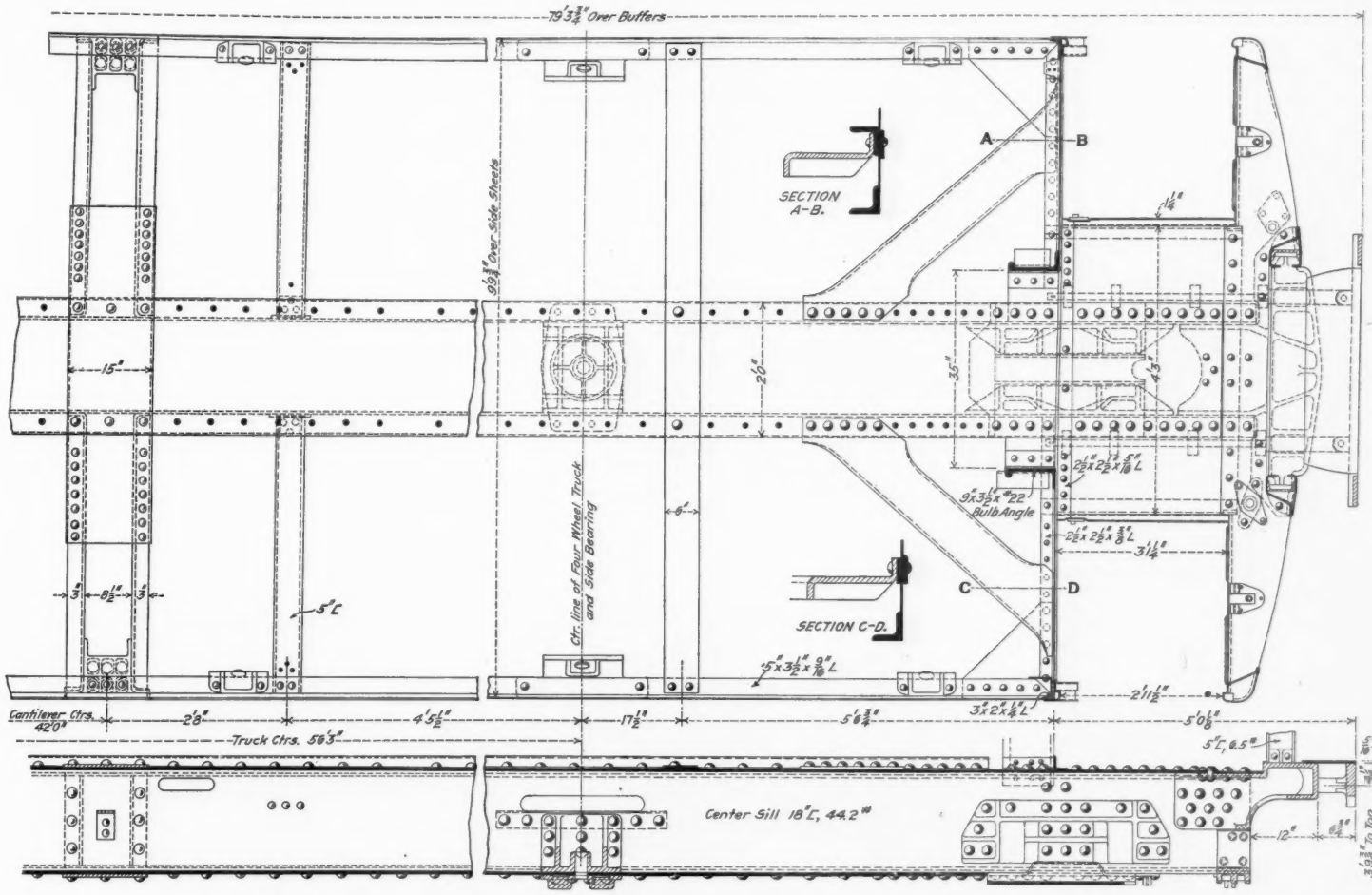
In the development of steel passenger cars the Pennsylvania has played an important part. When steel cars were proposed for use in the New York Subway, none of the car builders in the country was in a position to furnish them, and the first steel motor car was built at Altoona in 1902.

In 1904 designs were made for a 58-ft. passenger coach, which had a steel underframe and a steel outside sheathing up to the roof. The interior finish was largely of composite board and the roof was of wood covered with copper. One car of this type was built, but as it contained about 1,500 lbs. of wood further development of the design was considered necessary.

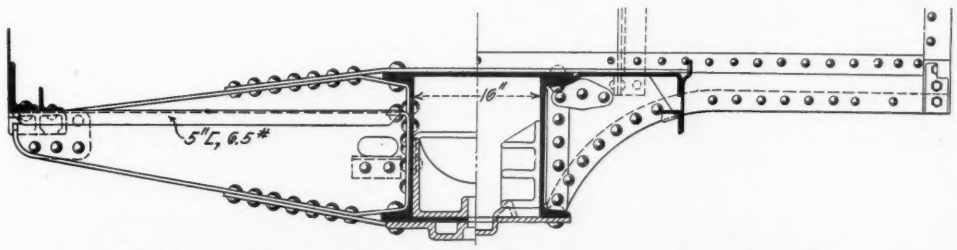
The next was a 60-ft. baggage car, completed in November, 1906, and closely followed by a 70-ft. mail car turned out in February, 1907. In the two latter cars only a small amount of wood was used.

Designs have now been prepared for a 70-ft. dining car, also for a 70-ft. passenger coach, which contains but 300 lbs. of wood (used for brake rod guards, window sash and arm rests for the seats). The interior finish is of steel except the headlining, which is of composite board. Designs are being completed for a suburban type car, 54 ft. 4 in. long.

In general arrangement and appearance, the heavy type 70-ft. coach is almost an exact copy of the standard wooden passenger coach. The underframe consists of two 18-in., 44.2-lb. channels with ½ in. x 24 in. cover plates top and bottom forming the center sill. Cast-steel center plates are riveted to the under side of the sill, which is reinforced at these points by steel castings riveted inside. Projecting beyond each end of the center sill are steel castings designed to transmit directly to the center sill the loads due to buffing, and to support the spring rods carrying the vestibule buffer plates. These castings are provided with projecting lugs and flanges to which the platform end sills and vertical channels forming vestibule posts are riveted. Within the center sill near each end are riveted steel castings arranged to carry the couplers and draft gear.



Detail of Underframe and Draft Attachments for Heavy Type Steel Car; Pennsylvania Railroad.



Part Cross-Sections Through Underframe; Heavy Type Steel Car.

The side sills are 5 in. x 3½ in. by 9/16 in. angles. Each sill is supported at its end by end sills, and at two intermediate points about 14 ft. from each end by cross bearers. The end sills are of cantilever form, riveted to the center girder and built up of angles, the outside sheathing plate acting as the web. The cross bearers are also of the cantilever form, each composed of two triangular plates flanged on the edges, and riveted at their base to the center sill. Opposite cross bearers are joined by cover plates which pass over the top and under the bottom of the center sill. Each side sill is held in line by nine struts of 5-in. channels connected to the center sill. These struts do not transmit any vertical load from the side sills to the center sill. Cast-steel side bearings are secured to the side sill in line with the center plates.

Pressed sheet steel posts spaced 5 ft. 11 in. centers support the superstructure. They are of channel section and the edges are flanged out and riveted to the inside sheathing forming a box sec-

tion. Their lower ends are securely riveted to the outside sills and their upper ends are tapered down and bent inward, forming lower deck carlines. At their upper ends these posts are riveted to the plate carrying the deck sash. The lower edge of this plate is bent out beneath the ends of the posts and forms a continuous beam of angle section running the entire length of the superstructure. Between the main posts are shorter intermediate posts, which extend only from the window sill to the plate carrying the deck sash. They are of light channel section with edges flanged for riveting to the outside sheathing, forming thereby a box section.

The upper deck carlines are of sheet steel pressed to channel section with edges flanged out for riveting to the $^{3}/_{32}$-in. steel roof-plate. Ends of the carlines are riveted to the plate carrying the deck sash. The upper edge of this plate is bent outward and down, forming a continuous beam of channel section, to which the edge of the roof-plate is riveted. Malleable iron braces unite the end of each post and its corresponding carline. The outside sheathing is $^{1}/_{8}$-in. steel and the course below the belt rail is riveted to the outside sill and vertically to each post.

The steel shape forming the under sill for the windows laps over the side sheathing, and rivets passing through the belt rail, which runs the entire length of the car, secure this joint. Outside sheathing above the windows is riveted vertically to the posts and its upper edge is riveted to a channel shaped steel section forming the eaves for the lower deck and extending the entire length of the superstructure.

Headlining for the upper and lower decks is of composite board secured to the carlines and posts with metal strips. Below the belt rail the inside sheathing is of $^{1}/_{16}$-in. steel, to the unexposed face of which $^{3}/_{16}$-in. asbestos is cemented. Bulkheads and remaining parts of the inside lining are of $^{1}/_{16}$-in. sheet steel. Mouldings, closely resembling those used in wooden construction, are pressed from steel and their use adds to the appearance of the interior. It has been possible to almost wholly eliminate machine screws from the construction, and economy in both construction and maintenance has been secured thereby.

The window sash are of wood and slide in a formed steel frame. (Steel sash have been successfully built, but wooden sash were deemed preferable.) Malleable castings riveted to the posts support the window frames. These castings are machined by jig, after riveting in place, so that the frames will be true and parallel regardless of any slight irregularity in location of the posts. Window stops, which also form ways for the curtains, are of extruded bronze. The deck sash are of malleable iron.

The floor is formed by corrugated steel plates which are supported by the center sill and upon longitudinal angles secured to the side posts. These corrugated plates are covered to a depth of 1½ in. with a plastic surface filling, composed largely of cement. A sub-floor of asbestos ⅝ in. thick supported by No. 20 galvanized sheet steel is secured to the center and outside sills. Along each side of the car just above the floor rectangular ventilating ducts are provided, which enclose the heating pipes and discharge warmed fresh air into the car.

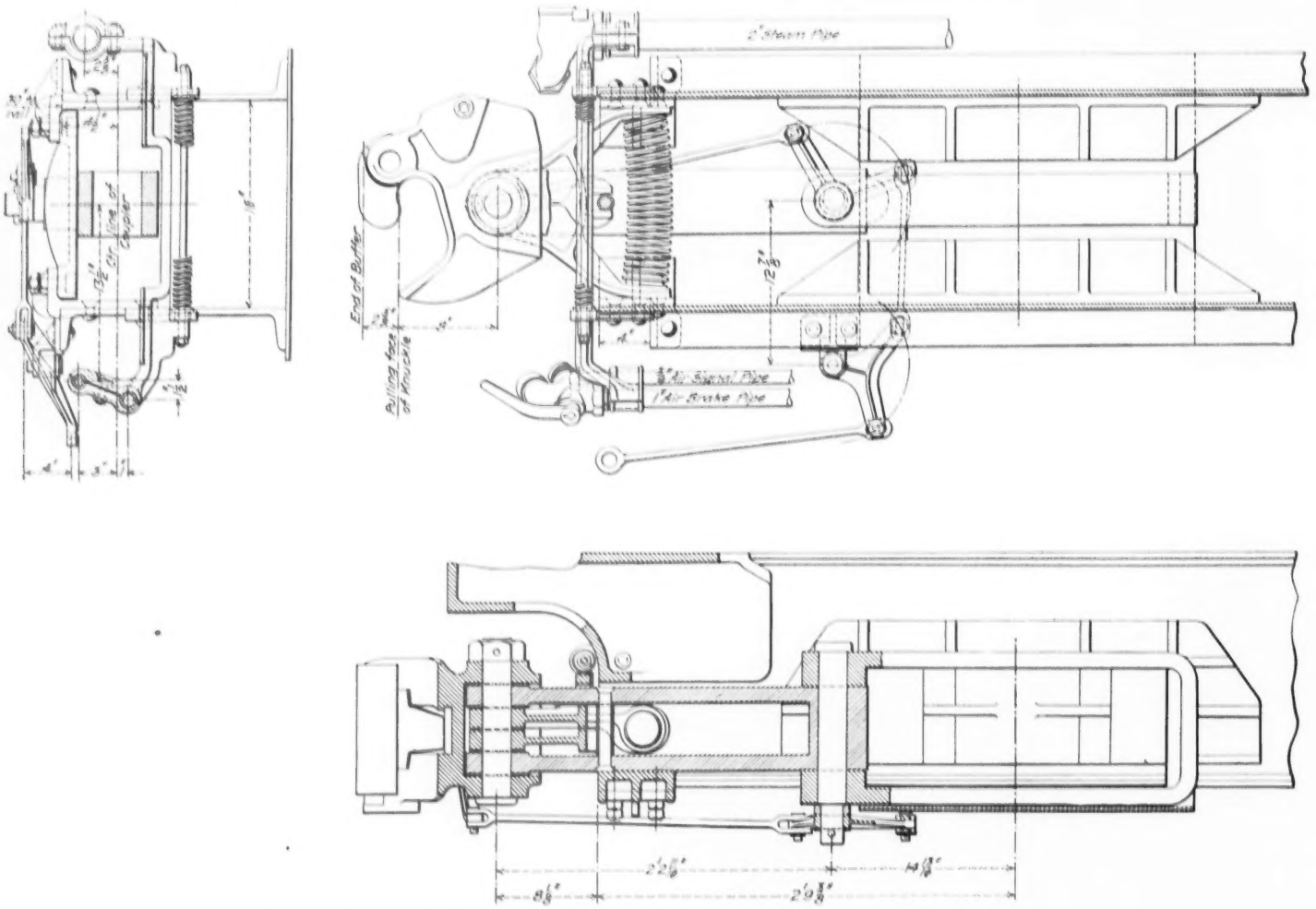
In designing the platform and vestibule an effort was made to secure sufficient strength in the end of the car to prevent the superstructure from being swept off from the underframe by the next car in event of a collision. The center sill is the main support of the entire vestibule and to it are securely framed the 9-in. bulb angles forming the end door frame together with the 5-in. channels forming the vestibule posts. These strong vertical members are relied upon to prevent damage to the superstructure during collision. The vestibule floor plate, the end sills and sheathing, and the vertical bulb angles, are securely framed together to give a strong foundation for the entire end construction.

Vertical corner angles uniting with the sides, and an angle across the top secured to the vestibule ceiling form the support for end sheathing. Two diagonal braces running from the eaves down to the floor, and securely riveted to the sheathing give additional stiffness to the ends. The end of the vestibule is supported by two outside posts of pressed sheet steel together with two channel posts forming a doorway. The base is formed by a pressed steel platform end sill, and the top support is given by the vestibule ceiling plate. Door jambs and lintels are of pressed steel (closely imitating the forms used in wooden construction), provided with cast diaphragms at intervals to prevent collapse and furnish support for attaching hinges, railings, etc. The end of the roof is of formed steel plates reinforced by angles secured to the end carline and the vestibule ceiling.

The general arrangement and appearance of the heavy type 70-ft. steel mail coach closely resembles the standard wooden car. It is, however, 10 ft. longer than former cars, and storage space is provided at each end instead of only at one end, thereby avoiding the necessity of turning the car around at terminals.

The underframe is similar to that used on the 70-ft. passenger coach, except that four side bearing plates are provided for each truck, and the ends are modified on account of the omission of the vestibule and side steps.

The end castings of the center sill are of such shape as to pro-



Application of Radial Coupler and Attachments; Pennsylvania Steel Cars.

vide rigid support for the door posts of 12-in. I beams. Their upper ends are securely framed into the roof structure so that an end shock to the car would be well distributed and not cause serious damage.

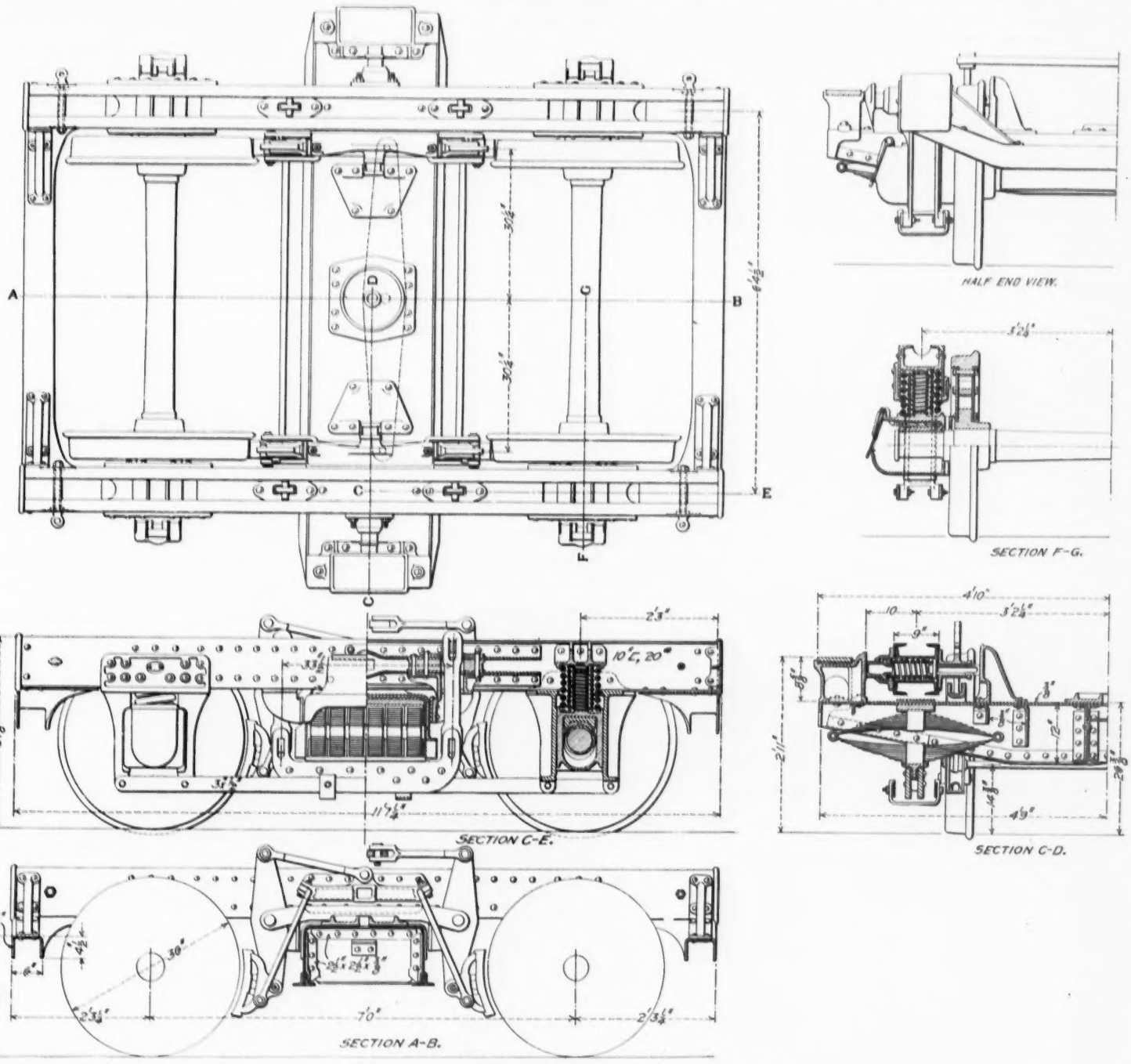
The roof construction is practically the same as that used in the passenger coach with the exception that the upper deck sash are of wood arranged to open for ventilation. The belt rail is of a flat bar instead of the formed section used on the passenger coach and between posts it is reinforced by a "T" section.

The window sash are of wood, the lower one is stationary and the upper one slides down. The upper sash is about twice the height of the opening it covers and its upper half is covered with a wire screen. When in the lowest position it affords ventilation through the screen, and in the upper position, glass closes the opening.

All the interior furnishings are of steel, conforming in dimensions to the requirements of the Post Office Department. The letter cases are built up with vertical partitions of steel plate and horizontal partitions formed by wires passing through holes in the verticals. Short horizontal plates are inserted between the verticals and secured to the horizontal wires to form the bottoms and tops of the pigeon-holes. Large and small paper cases are made of $^1/_{16}$-in. sheet steel, reinforced at the edges and similar in appearance to the cases used in wooden cars. The car contains but 370 lbs. of wood; it is lighted by electricity and heated by steam.

The general arrangement and appearance of the suburban type 54-ft. passenger coach are similar to the heavy type equipment, but the car is lower, shorter and the space allowed each passenger is less than in the larger cars. The arrangement of seats will be modified to suit the traffic and the saloon omitted if occasion warrants it.

The underframe construction closely resembles the heavy type car, but in order to provide sufficient space for motors the center sill is made more shallow. It is formed of two 10-in. channels with a single ¼-in. cover plate on top and two ⅜-in. cover plates on the bottom. This section keeps the center of gravity low and decreases the bending moment due to the fact that the drawbar is below the center sill. The center plate is of special form adapted to fit the same trucks used on heavy type equipment, and the casting enclosing the coupler and draft gear is attached to the under side of the center sill instead of being placed within it as in the heavy type car. Framing of the body is similar to that used in the heavy type coach, the main posts being identical except in the matter of length and shape at the top. There are three windows between each pair of main posts instead of two as in the heavy type coach.



Four-Wheel Steel Truck. Pennsylvania Steel Cars.

In order to complete its equipment of steel cars for passenger trains, the Pennsylvania Railroad has arranged with the Pullman Company to design and build all-steel parlor and sleeping car equipment. A sample sleeping car has recently been completed and is now at the Jamestown Exposition. In both exterior and interior appearance it closely resembles the standard wooden car, except in the delicate pearl grey interior finish, which replaces the highly polished natural wood.

Inside sheathing is of sheet steel, backed by asbestos board, to act as a non-conductor of sound and heat. Seat frames and berth fronts are of sheet steel, and window sash are of brass provided with automatic spring balances. Trucks are of standard Pullman

type supplied with cast-steel frames and bolsters, in place of the usual wooden members.

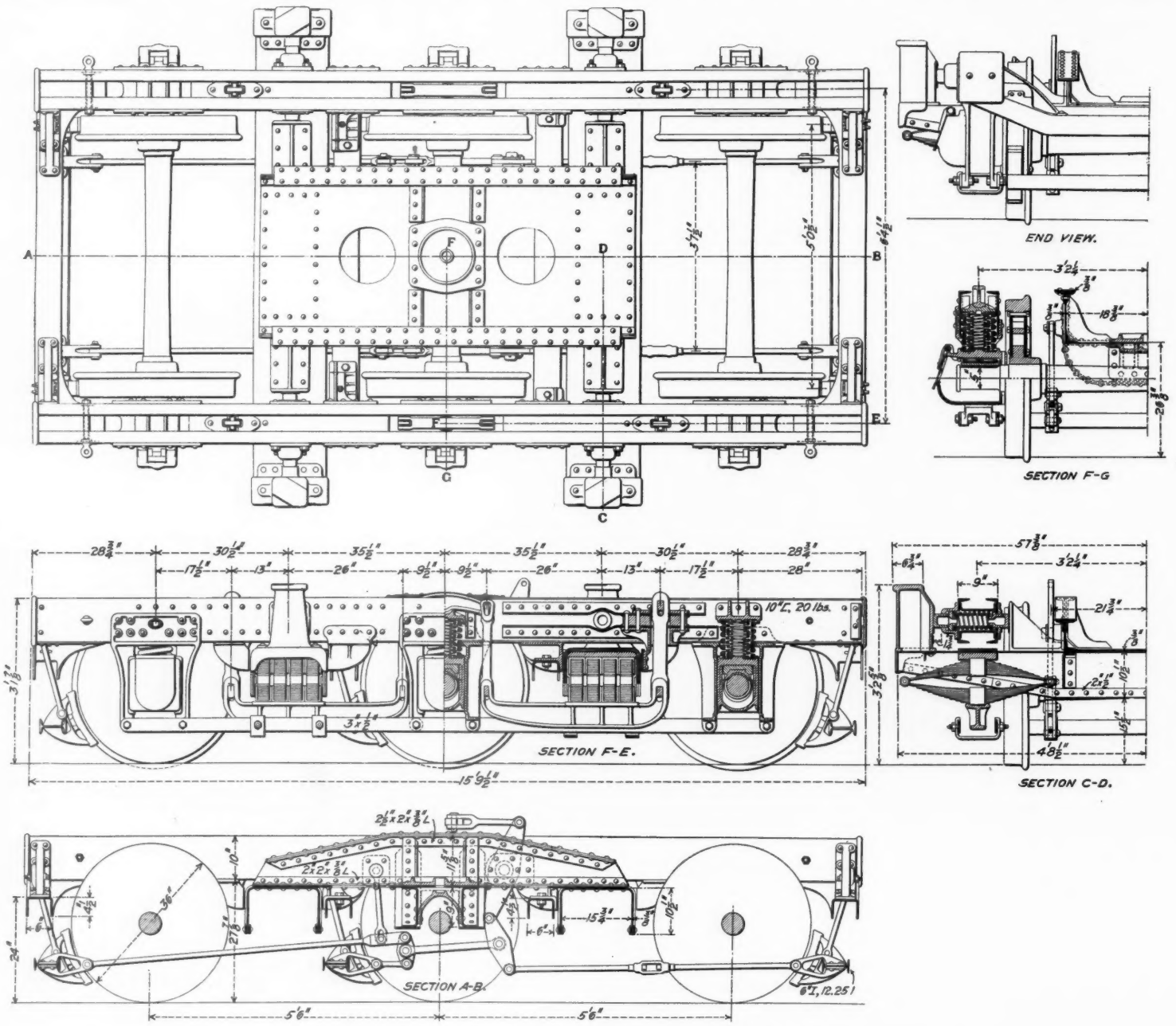
The principal dimensions of the car are:

Length over end sills	72	ft. 6	in.
Length over platforms coupled	80	" 6	"
Width over side sills	9	" 9¼	"
Width over eaves	10	" 0	"
Height over all	14	" 7	"

In preparing these designs great care was used to provide ample strength to resist end shock of buffing or collision. Standard steel freight cars are designed to resist an end shock equivalent to 300,000 lbs. compression. Experience with freight cars during the last five years indicated that this is not excessively high. In collision between passenger and freight cars it is desirable that the passenger car should be the stronger in order to escape with as little injury as possible. In computing loads upon the various members of the frame, therefore, it was decided that a compression load can roll completely over without danger of collapse. Posts, carlines and other parts are proportioned under this assumption.

In wooden car construction the center sills are usually rather shallow and the coupler is supported below them. Buffing loads tend to bend down the ends of the car due to the fact that the center sills are not symmetrically loaded. In these steel cars the center sill is made deep enough to bring the center line of draft within its section.

With the heavy center sills, body bolsters are unnecessary, for the major part of the transverse load is delivered directly to the center sill which transmits it to the trucks through center plates. The transverse loads which come upon the sides of the car and which must be transferred to the center girder are delivered at four points to equalize the loading. As a problem of design, the center sill is considered as a continuous girder, supported at two points by truck center plates and loaded with a practically uniform longi-



Six-Wheel Steel Passenger Truck; Pennsylvania Railroad.

of 250,000 lbs. between buffers, also 150,000 lbs. between draft gear, should be added to the normal loads due to the weight of the car and lading. Under these conditions the combined fiber stress is limited to 12,500 lbs. per sq. in. for cars in through train service and 20,000 lbs. per sq. in. for cars in suburban service. In determining these stresses none of the material above the belt rail was included. The sides of the cars beneath the window sills form girders about 3 ft. deep, for which the belt rail acts as the top flange and the outside sill the bottom flange. Owing to their great length, the thinness of the web, and the comparative shallowness of the flanges, these girders would probably collapse if subjected to end thrust. In calculations, therefore, the web and upper flange are not considered as resisting any of the 400,000 lbs. load assumed to represent the effect of buffing.

The superstructure of cars is made strong enough so that they tudinal load which it carries directly, together with four transverse loads delivered to it from the sides of the car through the cross bearers and end sills. The points of application of the concentrated loads are so selected that the two loads at each end are about equidistant from the center plate. Under this condition it has been possible to obtain in the center sill practically equal fiber stresses at the middle and over the center plates, thereby securing economy in metal and avoiding the use of a center sill of deeper cross section at the middle than over the trucks. Each of the four points of application is deflected practically the same amount. They therefore are always in line with one another and no load is placed upon the superstructure of the car by the unequal deflection of the center sill. With the comparatively thin sheet metal used in the sides and roof it is important to avoid unnecessary loading, as it is likely to cause loosening of the joints and working of the rivets

in their holes. With this form of construction the side girders can be made comparatively light as they sustain little transverse load and are supported at four points. Side doors required by mail, express or baggage cars can be located where most convenient without requiring any material strengthening in the side truss.

The following table gives the comparative strength and weight of steel and wooden cars:

	Passenger coach—		
	Standard, wooden, 53 ft. long.	Heavy type steel, 70 ft. long.	Suburban steel, 54 ft. long.
No. of passengers	62	88	72
Car weight, lbs.	91,000	113,500*	75,000†
Car weight per passenger, lbs.	1,470	1,290	1,042
Area center sill at midle of car, sq. in.	152	50	24.32
Area center sill at center plate or car, sq.in.	152	50	33.32
Stress in center sills,‡ lbs. per sq. in.	10,850	11,000	18,500
Comparative value of center sills, per cent.	25	100	60

*Estimated weight (including 6,000 lbs. storage battery).
†Estimated weight.
‡Due to 150,000 lbs. compression on draft gear and 250,000 on buffer.

An entirely new form of truck was required for the steel cars, owing to the fact that the deep center sill lowered the center plate until it just cleared the middle axle of a six-wheel truck. The new truck is applicable either to motor cars, or cars drawn by locomotives. It is designed to carry a load equivalent to the maximum capacity of the three 5 in. x 9 in. axles, but it weighs only 19,500 lbs., while the wooden truck, which was not as strong, weighed 21,700 lbs. Transoms, spring planks and equalizers are not required, as their functions are covered by other elements.

The drawing shows the construction of the truck. Two principal elements are embodied: the rectangular frame carrying the wheels, and the bolster which transmits the load delivered at the center plate to the axles through the spring rigging.

The axles run in boxes of the usual type which slide vertically in pedestals, secured to the wheel pieces and connected at their bottom ends by pairs of tie bars (sufficient space being allowed between tie bars to permit the use of a jack in removing bearings). Each wheel piece is composed of two 10-in. channels with their flanges turned toward each other, separated to permit certain of the parts to go between them, and secured to one another at intervals.

The two wheel pieces are held together by four pressed steel cross members of channel section, one at each end of the wheel pieces and one on either side of the middle wheels. They are depressed below the bottom of the wheel pieces in order to clear the center sill of the underframe. The bolster is composed of four girders running across the truck, to the top of which are secured two girders running lengthwise. The center plate rests upon the two short transverse girders of pressed steel. The lower flange of these girders is turned up at the ends and the plate riveted to the lower flange is brought up and riveted to the longitudinal girders. Between the girders is riveted a reinforcing casting to transmit the load delivered by the center plate. A horizontal rectangular plate forms the lower flange of both girders and acts as a diaphragm to square the bolster. Spring beams are riveted to the under side of girders and to the rectangular plate which forms their lower flanges. They extend on both sides beneath the wheel pieces and are confined between guides, which allow only vertical and transverse motion of the bolster with reference to the truck frame. The spring beams are of sufficient width to admit between their downwardly projecting legs four elliptical springs.

The entire load borne by the truck is delivered by its bolster to 16 elliptical springs which rest upon equalizers having ratio of 2 to 1. The equalizers are suspended from hangers, which deliver to each box of the middle axle one-sixth of the entire load borne by the truck and to each wheel piece one-third of the entire load borne by the truck. This load is delivered to the wheel piece at two points near the outside pedestals so that each box of the outside axles receives one-sixth of the entire load borne by the truck. Each box receives its load through a nest of three helical springs, which in the case of the end axles, bear upon castings secured to the wheel pieces, and in the case of the middle axle, bear upon short equalizers connected to hangers. The boxes of the middle axle, therefore, move up and down freely and without any connection or relation to the wheel pieces.

Side motion of the bolster relative to the wheel pieces, provided for by the hangers and guides, is limited by the abutments secured to the spring beams. Helical springs, resting upon followers guided by the wheel pieces and engaging these abutments, center the bolster and give easy riding qualities equal to those secured by the link suspension generally used on wooden trucks. The outer abutments also act as side bearings for the car body and engage castings secured to the outside sills.

Most of the parts used in the six-wheel truck also enter into the four-wheel truck, which is similar in principle. As in the case of the six-wheel truck, a considerable saving in weight has been brought about by the change from wood to metal. The steel truck weighs 12,500 lbs. while the wooden truck weighs 16,000 lbs.

The frame of the four-wheel truck is similar to that of the six-wheel except that the wheel pieces are connected by only two cross members instead of four. Consolidation of the two spring beams of the six-wheel truck into one, and elimination of the longitudinal girders and transverse girders, which become unnecessary, produces a simple bolster of channel section reinforced at the middle for the center plate and broad enough to cover six elliptical springs.

The entire load borne by the truck is delivered by its bolster to 12 elliptical springs which rest upon carriers suspended from hangers which are hung from the wheel pieces. No equalizers are necessary as the wheel pieces perform that function. Each axle box receives its load through a nest of three helical springs, which bear upon castings secured to the wheel pieces, in the same way as the outside axles of the six-wheel truck. Side motion of the bolster relative to the wheel pieces is provided in the same manner as in the six-wheel truck. Some of the parts are slightly different in form in order to act as supports for the brake rigging.

In redesigning the six-wheel truck careful consideration was given to the brake rigging, and a system was devised embodying the principle of an independent set of triple brakes for each side of the truck, which apply their braking force to the brake-beams adjacent to the brake heads, thereby avoiding the heavy bending strains usually present in brake-beams. In the brake rigging of the four-wheel truck the principle of an independent set of duplex brakes for each side has been carried out, and brake-beams have been entirely dispensed with by directly suspending the brake heads from hangers attached to the wheel pieces.

It was found that the standard form of drawbar and coupler heretofore used on wooden cars did not allow sufficient side motion of the coupler head in rounding curves. The binding was particularly noticeable upon long cars, and to remedy the defect an entirely new arrangement was devised by means of which a lateral motion of 8 in. each side of the center was secured.

The construction and operation of the coupler are shown in the drawings. The drawbar at its inner end is connected to the draft gear by a pin and at its outer end is connected to the coupler head by another pin. The socket of the coupler head, into which the drawbar enters, is broad enough at its end to allow considerable rotation of the coupler head with reference to the drawbar about the pin.

Pivoted about the outer pin, between the two jaws of the drawbar, are two levers. Their outer ends are pressed apart by a helical spring and engage faces formed by vertical webs of the center sill. The outer edges of these levers engage the inner faces of cavity in the coupler head. The helical spring serves the double purpose of centering the coupler head with reference to the drawbar and also of centering the drawbar with reference to the center sill.

If the coupler head should be rotated about its pivot so that the outer end would move to one side, one lever would be rotated at the same time due to its engagement with the inner face of the coupler head socket. This motion would compress the helical spring, which would tend to restore the coupler head to its central position as soon as the acting force was removed. A movement of the character just described would probably take place in coupling, if the couplers were not in perfect alinement with one another.

In rounding a curve, the drawbar pivots about the inner pin giving its outer end a lateral motion. If the outer end of the drawbar moved to the left the connecting lever due to its engagement with the center sill would rock about the outer pivot toward the center line of the drawbar, thereby compressing the helical spring, which would tend to restore the drawbar to its mid-position as soon as the acting force was removed. During the action just described the other lever would not move with relation to the drawbar, as its lug would engage the small pin on the drawbar due to the thrust exerted by the helical spring.

In the uncoupling device a large amount of side motion given to the coupler head would require considerable slack in a chain connecting with the uncoupling lever upon the platform. To avoid possibility of trouble from this source, bell crank levers coupled by rods have been introduced into the connection with the uncoupling lever. Their form and points of application have been so chosen that any motion of the coupler head will not affect their successful operation.

Because of the large amount of side motion, the coupler heads would interfere with steam and air-pipe valves in their regular position. A yoke has been provided, which slides laterally in bearings, and to which the ends of these pipes are secured. A helical spring maintains this yoke in its central position, and it is moved laterally when the drawbar moves by the sides of the drawbar engaging lugs on the under face of the yoke.

The steel cars will be lighted entirely by electricity, current being furnished by storage battery, trolley connection, axle generators or train generators as the conditions may require. Incandescent lamps will be used for side lights and in the toilet rooms, while in the body of the car special lamps and reflectors will be employed.

Passenger coaches will be equipped with a ventilating system by which, with all windows and doors closed, each passenger will be supplied with 1,000 cu. ft. of fresh air per hour, which is equivalent to a complete change of air in the car every four minutes.

The system employed was developed after careful experiments and has been successfully used in over 1,000 wooden cars. Air is taken in by two hoods situated on diagonally opposite corners of the car roof. From each hood a vertical duct leads down, within the side of the car, to a horizontal duct which runs the entire length of the car, between the floor and the sub-floor next to the side sill. Above the floor of the car, and running its entire length along the sides, are rectangular ducts containing the steam heating pipes. Air entering the hood passes down to the duct beneath and along this to openings into the duct containing the heating pipes. After circulating about the heating pipes and becoming thoroughly warmed it is delivered into the aisle of the car through tubular outlets beneath each seat.

Air is discharged from the car through ventilators in the roof, which are provided with valves to limit the amount of air passing. Movement of the car forces the air into the car under slight pressure, and limiting the discharge maintains the pressure and prevents the entrance of cold air through cracks about the doors and windows. The ventilation system works equally well in either winter or summer, but the warming of so much fresh air requires considerably more steam than would be needed by the usual methods of heating without much if any ventilation.

In suburban cars heated by electricity, it will be impractical to supply sufficient heat to warm the great volume of air required for ventilation, and these cars will, therefore, be ventilated in the usual way, by opening windows or ventilating sash on the roof. As passengers in this class of service usually make trips of comparatively short duration, the means of ventilation supplied will doubtless prove satisfactory.

Foreign Railroad Notes.

The short but costly ship canal across the isthmus of Corinth, which greatly shortens the passage from the Adriatic to the Ionian Sea, has long been bankrupt. It was a de Lesseps undertaking, but vessels refused to use it, and it is not wide enough for the large modern steamers, such as carry grain from the Russian Black Sea ports. The canal was sold under foreclosure of mortgage March 17 and was bought by the National Bank of Greece for $83,420. It cost many millions.

In 1906 the shipments of butter westward over the Siberian Railroad amounted to 52,213 tons, thus averaging 143 tons daily. This was nearly one-half more than in 1905, but only 29 per cent. more than in 1903.

Steel Postal Cars for the Harriman Lines.

In the *Railroad Gazette*, June 22, 1906, we showed drawings of the new standard steel postal car of the Harriman Lines. One of the first cars built to these drawings was recently completed at the Sacramento, Cal., shops of the Southern Pacific. The accompanying illustrations show interior and exterior views of the car, which has the following general dimensions:

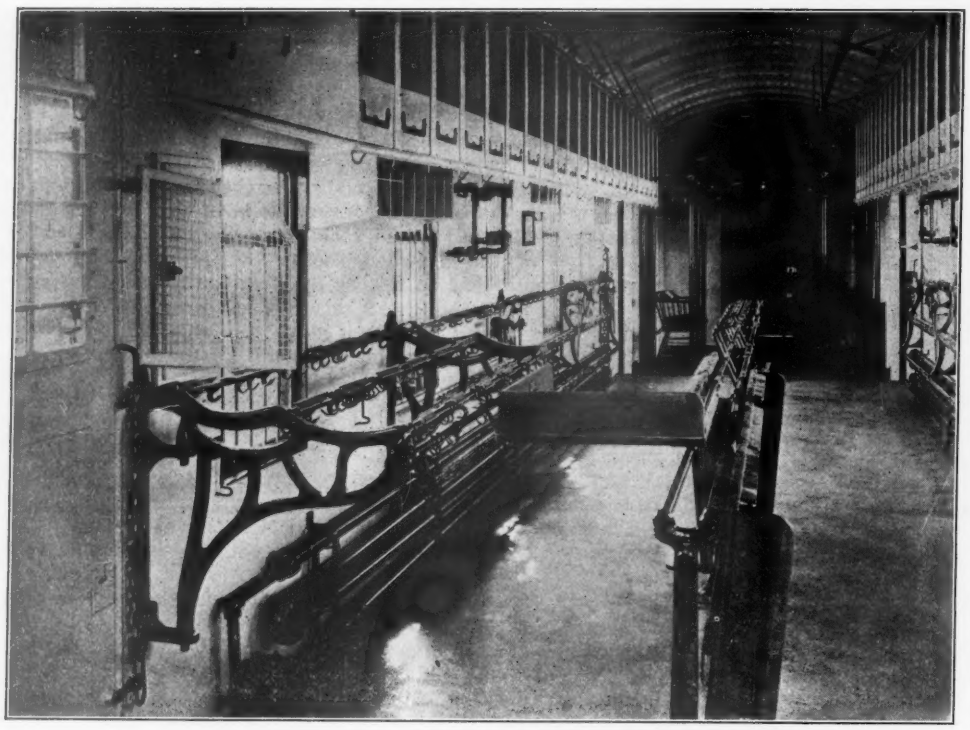
Length of body over end sills	60	ft. 2	in.
Width of body over side sills	9	" 9⅝	"
Width at eaves	9	" 10⅛	"
Height from top of rail to eaves	9	" 7¼	"
Height from top of rail to top of roof	13	" 10⅝	"
Distance, center of bolster to end sill	8	" 0	"
Width inside	9	" ⅝	"
Length inside	60	" 0	"
Height inside	9	" 4⅝	"
Light weight	107,000	lbs.	

The underframe consists of two 12-in., 31.5-lb. I beams spaced 16 in. center to center of webs, and reinforced by two 1½-in. truss rods with a drop of 12 in. at the middle beams. The draft gear is secured to the bottom flanges of these I-beams, which extend from end sill to end sill. The sides of the car below the belt rail form deep plate girders which transmit their load to the center sills at the bolsters and at the heavy needle-beams 10 ft. apart in the middle of the car. The belt rail forming the top flange of the girder is a 2¼-in. x 4-in. x ⅜-in. angle, and the bottom flange or side sill is a ½-in. x 3-in. x 7-in. angle. The web plate or side sheathing is a $^{3}/_{16}$-in. steel plate riveted with buttonhead rivets to the top and bottom flanges and to the side posts which form vertical stiffeners. The continuity of of the side plate is broken by the two side doors. The door openings are framed with heavy angle posts and in addition diagonal braces are carried up on each side from the side sill angle to the plate, in effect forming an A-truss over each door. The upper side sheets are ⅛-in. plate.

The end framing is made heavy and strong to prevent telescoping. There are four posts on each side of the end door made up of 3½-in. x 6-in. x ⅜-in. angle reinforced with ¾-in. x 3-in. plates and extending from the end sill to the reinforced end plate. The roof is curved and without the usual upper deck. All the framing is of light angles bent to shape, to which are riveted the inside and outside roof sheets $^{1}/_{16}$ in. thick. The inside sheets are flanged to form panels 24 in. wide between carlines. The floor is composed of two layers of corrugated steel separated by a layer of hair felt and covered with monolith.

The car is mounted on six-wheel trucks and lighted by electricity generated from the axle. Cottier ventilators placed radially in the roof provide the necessary ventilation. The other fittings are standard designs.

Steel Mail Car; Southern Pacific.



Interior of Steel Mail Car; Southern Pacific.

Master Mechanics' Association Committee Reports.

We give below abstracts of nine of the eleven committee reports presented to American Railway Master Mechanics Association convention this year. The reports of the committees on superheating and widening gage of track on curves will be abstracted in a subsequent issue. With the exception of the report on motor cars, the committee work of the year is uninteresting compared with previous years.

SUBJECTS.

The committee suggests subjects for the noon-hour discussions at the 1907 convention, also subjects for committee work and individual papers, for the 1908 convention as follows:

Topical Discussion.

First day.—Apprenticeship System on the New York Central Lines. To be opened by Mr. C. W. Cross.

Second day.—1. Is it desirable to eliminate water gage glasses on locomotives to enforce the use of gage cocks? To be opened by Mr. F. F. Gaines.

2. Relative merit of outside and inside delivery pipes in connection with locomotive injectors. To be opened by Mr. Strickland L. Kneass.

Third day.—1. The corrugated tube for locomotive service with the view of bringing out the reasons and advantages for its use. To be opened by Mr. G. W. West.

2. What is the best metal for hub liners for driving and engine truck wheels, the best method of applying and the limiting lateral hub play for such wheels before repairs are required? To be opened by Mr. J. F. Dunn.

Committee Reports.

1. Laboratory test of various valve gears being used—Stephenson, Walschaert, Alfree-Hubbell and Young—at Purdue or Altoona, to determine their relative efficiency. R. D. Smith (Chairman), F. H. Clark, W. F. M. Goss.

2. Best system of washing out and refilling locomotive boilers, including blow-off lines, flushing tanks, hot wells and other similar methods and data pertaining to benefits in the way of reducing defects in firebox sheets, staybolts and tubes. H. T. Bentley (Chairman), L. H. Turner, W. R. McKeen.

3. Organization of large railroad shop forces. H. H. Vaughan (Chairman), James Milliken, W. H. Lewis, T. S. Lloyd, A. E. Manchester.

4. A system of accounting for labor and material for railroad repair shops. H. Emerson (Chairman), T. H. Curtis, Le Grand Parish.

5. Handling scrap. H. D. Taylor (Chairman), D. J. Redding, A. Forsyth.

6. The use of castellated nuts for machinery of locomotives with a view of having some standard dimensions established. Committee to be appointed by the Executive Committee.

Individual Papers.

Is it desirable to have uniform specifications and drawings of locomotives covering the most common types and sizes? By G. M. Basford.

Standard definition of the term "engine failure," with a list of locomotive characteristics and the numerous varied conditions of operation on which any definition would need to be predicated, in order to enable comparison to be made. By M. K. Barnum.

Design and strength of crank axles for balanced compound locomotives. By F. J. Cole.

The report is signed by Henry Bartlett (Chairman), J. A. Carney, R. P. C. Sanderson.

MECHANICAL STOKERS.

Since the last convention, trials of the Day-Kincaid, Hayden and Krouse automatic stokers for locomotives have been continued by various railroad companies. The data obtained from these tests are not, as yet, in sufficiently conclusive shape to make it desirable to present same to the Association. One of the larger railroads in the country has prepared designs of two types of experimental stokers, the test of which, it is expected, will be started at an early date. The state of the art is such that the committee can only make a progress report at this time.

The report is signed by Wm. Garstang (Chairman), D. F. Crawford, J. F. Walsh, G. F. Hodgins.

DEVELOPMENT OF MOTOR CARS FOR LIGHT PASSENGER SERVICE.

This report deals simply with the development of the motor car in this country during the past year, and the situation as it exists abroad at this time.

Gasolene Motors—Mechanical Transmissions.

Union Pacific.—This railroad has built nine gasolene motor cars, all of which have direct mechanical drive. The latest design of car is equipped with a 200 h.p. motor, of six cylinders, 10 in. diameter by 12 in. stroke. The total weight of the car is 61,300 lbs., equivalent to practically 300 lbs. weight per 1 h.p. This car has, since last summer, been running regularly between Beatrice and Lincoln, Nebraska. Ten additional cars, similar to this successful model, are being built, as well as a number of trailers to be used in connection with them. Four regular branch line services have been maintained in Kansas and Nebraska, on the Union Pacific, during the severe weather conditions of the past winter, with success. After two years of continuous service, it has been found that the average cost of fuel the year around, taking into consideration both summer and winter conditions, using 72 deg. gasolene, amounts to 3.5 cents per car-mile. As a substitute for gasolene, California distillate has been used in regular service with good results. The distillate is a much cheaper product than gasolene. Some experiments have been conducted, using denatured alcohol as fuel. The results were satisfactory, in fact the motor gives equally as good performance with that fuel as with gasolene.

"Sunny Brook."—A light motor car, recently built at Indianapolis, Ind., for service in Yellowstone Park. This car has a four-cylinder gasolene motor, cylinders 6 by 6 in., the engine developing 50 h.p. at 700 r.p.m. The car is built after the conventional street car design and weighs 30,000 lbs. At full speed the car can attain 35 miles per hour. The transmission is of the mechanical type with three speeds forward and three reverse, with chain drive of the Renold silent chain type.

Gasolene Motors—Electric Transmission.

Strang Cars.—Three Strang cars are in regular operation between Kansas City and Olathe. The first one has been in continuous service for over a year, the second and third cars having been in operation between six and seven months. Other cars of this type are now under construction for use on several steam roads. In the Strang system the generator is direct connected to the motor, forming a self-contained generating unit. Directly from the brushes of the generator, main wires lead to a controller of the series-parallel type. From this controller, wires lead to electric motors hung on the axles of the front trucks according to standard electric railway practice. In multiple with the wires between the generator and controller is connected a small storage battery, and in one of the main wires between the battery and the generator is placed a rheostat, which is used for the purpose of temporarily converting the generator into a motor when starting the engine. The first of the above-mentioned cars weighs 78,000 lbs., and the gasolene consumption has averaged about 0.45 gallons of gasolene per motor car-mile for a mileage of 60,000 miles. The largest car is 52 ft. 9 in. long, weighs 84,000 lbs., and has the following equipment: 100 h.p. gasolene engine, 50 k.w. generator, two 65 h.p. motors and storage battery of 112 cells, with 250 a.h. capacity.

St. Joseph Valley Traction Company.—The motor car used on this road has been in actual daily service for two years. The service of this car consisted in hauling from one to three trailers, three round trips per day, over a road 11½ miles long, making the half trip in 35 minutes with four stops, the heaviest grade being 1½ per cent. The fuel consumption with one trailer was 0.75 gallon per mile. The motor consisted of a four-cylinder, 70 h.p. gas engine direct connected to a 50-k.w., 250-volt generator in parallel with which was connected a battery. Four 50 h.p. motors were used on the trucks. Weight of motor car 70,000 lbs.; trailer 38,000 lbs.

General Electric Company Car.—The car body is of steel, the ends being rounded to decrease wind resistance. The roof is of the Mann type, equipped with globe suction ventilators. The car body is divided into an engine compartment, baggage, smoking, main and toilet compartments, and operating cab at rear end. It has a seating capacity of 40. The equipment consists of an eight-cylinder V construction gasolene motor of 150-175 h.p., direct connected to an 8-pole, commutating pole, 90 k.w. generator with an exciter of 3½ k.w. capacity, for the purpose of exciting the fields of the main generator, and effecting the variable potential control. From the generator, leads are conducted to two 65 h.p. motors, one on each truck of the car. These motors are always connected in parallel, the required torque or speed being obtained by varying the field current of the generator through a specially constructed controller, embodying essentially the required resistance suitably arranged in 15 steps. The gasolene motor is of the four-cycle type, equipped with two separate systems of ignition; one, the high tension using induction coil connected to a four-volt storage battery, the other make-and-break connected to a direct-driven Simms-Bosch low tension magneto. The carbureter is of the single-nozzle hand-compensated type, gasolene being supplied to it by means of a diaphragm pump. Radiators for water cooling are located on the roof of the car. The circulation is by thermo syphon. The gasolene motor is controlled by one lever superimposed over the controller handle. The normal speed of motor is 550 r.p.m. The car is heated by by-passing as much as required of the exhaust gases through pipes approximately in the same position as steam pipes in the standard railroad coach. An acceleration of a mile per hour per second is obtained to approximately 25 to 28 miles per hour. From this point,

acceleration falls off gradually until full speed is attained at approximately 50 to 55 miles per hour. The total weight of the car is 60,000 lbs.

Steam Motors.

Canadian Pacific.—This car was in operation all summer between Montreal and Vaudreuil, a distance of 24 miles, giving a service of three round trips per day, on a regular schedule, allowing one hour for the run out, including 12 stops, and the same on the return trip. It gave fairly good satisfaction to the railroad company. The boiler is of the return tube marine type, carrying 180 lbs. pressure, equipped with superheater coils and a "Morrison" furnace, brick lined; crude oil is used as fuel with a burner of the "Booth" type having 1-in. slot. The cylinders were originally turned out with bushes 10 by 15 in., but after a time the bushes were removed, leaving the cylinders 11 by 15 in. The valves, which are of the piston type, are fitted with "Walschaert" gear. When the car was first put into service, 1.8 imperial gallons of oil were consumed per mile, but as the men gained experience the consumption was reduced to 1.6 imperial gallons per mile; 5,000 gallons of water were evaporated per hour, giving a factor on 1 lb. of oil to 10 lbs. of water. Experiments have recently been made on the testing plant at the Canadian Pacific shops with the same boiler and motor, using ordinary run of mine coal as fuel, instead of oil, with satisfactory results. During a test of 1½ hours, an average steam pressure of 172 lbs. was maintained at a speed of 47½ miles per hour. Total water evaporated, 8,569 lbs.; water evaporated per hour, 5,720 lbs.; total coal consumed, 1,300 lbs.; pounds of water evaporated per pound of coal, 6.6; average temperature of gases in combustion chamber, 952 deg. F.; average temperature of steam at steam chest, 578 deg. F.

Ganz Cars.—Motor cars of this type are being built for four different roads in the United States. All-steel construction is used for the body, which has a seating capacity for 52 passengers. Total weight of car in working order is 70,000 lbs. The boiler or steam generator carries a working pressure of 270 lbs., the steam being superheated; capacity 120 h.p. The steam motor is of the enclosed type with compound cylinders, all moving parts running in oil. It is mounted in the forward truck and drives the rear axle thereof through one set of gears. This car is designed to maintain a speed of 35 miles per hour on a level track. Average fuel consumption is claimed to be from 10 to 12 lbs. coal per mile.

Foreign Cars.

Numerous English and Continental railroad companies have permanently established rail motor car service in different localities with marked success. A brief description of the motor cars in operation on the principal railroads of England and the Continent is given herewith.

Gasolene Motors—Mechanical Transmission.

German Daimler Car.—Has been used in considerable numbers on some of the smaller German railroads, notably the Wurtemburg State Railway and on the Swiss Federal Railway. It is a small car, having a total length of 33 ft., with a seating capacity of 36. It is equipped with a 30 h.p. Daimler engine of the heavy, slow-speed type, its normal speed being about 550 r.p.m. The motor has four cylinders 5¼ in. diameter by 6¾ in. stroke. It is located in the middle of the car, attached to a subframe upon which the car body is supported by eight elliptic springs, the subframe being carried rigid on the two axles. Power is transmitted from the motor through a leather-faced cone friction clutch, and through a sliding gear transmission (arranged to give four speeds and reverse) to one of the axles. Control levers are provided at each end of the car, by means of which the speed of the motor, or the direction of motion, is controlled from either platform.

Gasolene Motors—Electric Transmission.

North-Eastern Railway.—The power plant consists of a four-cylinder horizontol opposed Wolseley gasolene engine (8½ by 10 in., 85 B.h.p. at 420 r.p.m.) directly connected to a compound wound, separately excited generator, of 55 k.w. capacity, which furnishes current to two 50 h.p. electric motors, of the ordinary railroad type, on the leading truck. The total weight, including 60 gallons of gasolene and about 100 gallons of cooling water, is 35 tons, of which 22 tons are carried on the power truck. These cars are used during the summer season only. Three and one-half car-miles per gallon of gasolene is claimed for them. As this particular type of car has not been perpetuated by the original builders and users, it is safe to assume that it is not entirely satisfactory. The enormous size and weight of the power plant and the space occupied (being about one-third the total length of the car), are undoubtedly the reasons for discontinuing the construction of this design.

Arad & Csanadar Railway.—On the Arad & Csanadar Railway, in Hungary, a number of gasolene electric cars are used, the largest of which has a 70 h.p. gasolene motor direct connected to a 45 k.w. generator, which supplies current to ordinary railroad type motors attached to the two axles. The usual series parallel controller is provided for starting. After the car is once under way, its speed is almost entirely controlled by the throttle of the gas engine. Controlling apparatus is provided at only one end of the car. The car is equipped with air and hand-brakes, air being supplied by a small compressor driven from the outer end of the armature shaft. Jacket water from the motor is passed through coils inside the car for heating during cold weather. When no heat is required the water is passed through a coil of tubes on the roof. The space occupied by the power plant is considerably less in proportion to the length of the car than that of the North-Eastern Railway, although the systems are practically identical in principle. The acceleration of the car is good. Its maximum speed is about 35 miles per hour without trailer. It is claimed that 65 per cent. of the power is delivered at the wheels. Satisfactory results are reported from these cars.

Steam Motors.

Great Western Railway of England.—Sixty of these cars are in service and others are in course of construction. They combine large seating capacity with moderate weight, flexibility of control, reasonable speed and acceleration, reliability, low maintenance and fair operating costs. The boiler is of the vertical, fire-tube type with no superheater, supported directly on the frame of the power truck and serving as a center pin by transmitting the driving effort to the sills of the car through flat springs. It is enclosed within a compartment of the car body (about 14 ft. long), which contains coal bunkers, operating levers, etc. As the car is arranged to run in both directions and controlled from both ends, a stoker is employed in addition to the driver. Aside from attending to the fire, it is his duty to regulate the cut-off when the driver is at the other end of the car, as only brake and throttle connections are provided there. The motor consists of two single-expansion cylinders, 12 by 16 in., coupled direct to the rear driving wheels, which in turn are coupled to the front drivers. Walschaert valve gear is used. The water supply is carried in tanks hung beneath the car body midway between the trucks. The cars are equipped with brakes. A maximum speed of 55 miles per hour can be obtained, although the average running speed is from 30 to 35 miles per hour. The maximum acceleration is about one mile per hour per second.

Taff-Vale Railway.—The Taff-Vale Railway has built a number of cars for its own use and for other railroads, similar in design to the Great Western car, the chief difference being in the construction of the boiler. This is of the fire-tube type and consists practically of two horizontal barrels placed on either side of a central furnace, the hot gases passing horizontally through the fire tubes to a smokebox at the outer ends, and from there through the flues to a central stack. The boiler is placed transversely with reference to the car body and rests directly upon the truck frame back of the forward axle, which is the driving axle. The forward end of the car body is pivoted on the power truck, but does not include a compartment for boiler equipment as in the case of the Great Western. The power truck is self-contained and a cab is provided for the driver similar to that of a small locomotive. The cylinders are placed outside and the valves operated by an ordinary link motion with rocking shaft. This car is capable of running 35 miles per hour on the level and will ascend a 2½ per cent. grade at 20 miles per hour. It can be operated from either end, and all operation, except starting, performed from the guard's compartment. The general dimensions of the latest type of Taff-Vale car are: Over all, length, about 70 ft.; seating capacity, 43; total weight, 42 tons; weight on power truck, 30 tons; cylinders, bore 10½ in., stroke 14 in.; total heating surface of boiler, 465 sq. ft.; grate area, 10 sq. ft.; capacity of water tank, 550 gallons; steam pressure, 180 lbs.; tractive force, 5,292 lbs.; boiler has 232 1⅝-in. tubes.

Lancashire & Yorkshire.—Has cars similar to the Taff-Vale, in that the forward end is pivoted on the power truck. The boiler is of the usual locomotive type with horizontal fire-tubes. This engine is practically a small locomotive with drivers coupled. The following gives the principal engine and boiler dimensions: Heating surface, 509 sq. ft.; grate area, 9.4 sq. ft.; water capacity, 550 gallons; boiler pressure, 180 lbs.; coal, 1 ton; two cylinders, bore 12 in., stroke 16 in.

Ganz System.—Ganz cars are used extensively in Central Europe in three sizes, 35, 50 and 80 h.p. at 260 r.p.m. The boiler is placed in a compartment at the forward end of the car, together with fuel bunker, feed pumps and controlling apparatus. The motor is placed horizontally on the leading truck, and drives the rear axle through spur gears. It is supported in the usual electric railway motor style, one end being swiveled above the axle, and the other supported elastically from the truck frame. The car is controlled from only one end and one man is required to operate it. The boiler consists of four concentric cylinders with headers (held in place by bolts) forming two annular water spaces joined together by means of slightly inclined steel water tubes, 25 mm. outside diameter and 2 mm. thick. Within the inner cylinder is another cylinder of slightly smaller diameter through which the fuel is fed to the grate below, the flame and hot gases passing around the water tubes to the stack. The motors are two-cylinder cross compound. The largest car, 80 h.p., weighs 23 tons, and is capable of climbing 1.6 per cent. grade, with two trailers weighing 12 tons each, at a speed of 25 miles per hour.

Purrey System.—The Paris-Orleans road has 10 cars and 12 power trucks equipped with this system. It has also been used for a number of years on different tramway lines in the city of Paris. The Paris-Orleans cars have a total length of about 60 ft. with a capacity of 30 third-class passengers in three compartments, and 25 first-class passengers in 2½ compartments, and in addition there is a baggage compartment at the forward end 11 ft. 6 in. long. The forward end is pivoted on the power truck, the rear end being carried on a single axle. The total weight of this car is about 35 tons. The power truck which carries the boiler, motor, fuel, water, etc., has a 126-in. wheel base, the rear wheels only being used for driving. The Purrey boiler is tubular, consisting of two drums, the lower one of rectangular section and made of cast-steel, the upper one cylindrical and of cast-iron. The lower drum is divided into three compartments, two of which are provided for water, the third being for superheated steam. The outer and lower compartment is connected with the upper drum by two large return pipes. It is also connected with the intermediate compartment of the same drum by 41 U-shaped tubes. The feed-water entering the lower compartment is thus heated in passing through these tubes, which are in direct contact with the flame. From this point the water rises through a series of U-shaped tubes to the upper drum, and the steam thus formed is returned from the upper drum through a number of similar tubes to the third compartment of the lower drum, from which it is taken to the motor. The steam is highly superheated in these tubes, the average temperature of superheat being from 750 deg. to 900 deg. F. Coke is used for fuel, feeding automatically from a bunker attached to the side of the boiler, the supply being regulated by a vertical sliding door. The motor is a four-cylinder tandem compound, rated at 260 h.p. at 650 r.p.m. Ordinary D-type valves are used, operated through Stephenson link motion. In this design the motor is attached horizontally to the frame of the car and its power transmitted to the rear axle by two toothed chains of similar construction to the Renold and Morse silent type. As a rule, one or two trailers are attached to these cars, the average weight of the train being 50 tons. The fuel consumption of this train is about 21 lbs. of coke per mile. The car is capable of maintaining a speed of about 56 miles per hour. The cost of operation per train-mile is about 7 cents.

Serpollet System.—The Serpollet system differs from the Purrey and Ganz types chiefly in that the boiler is of the flash type, and kerosene is generally used as fuel. A very high degree of superheat is obtained (reaching even 1,200 deg. F.), which, together with the incrustation attending the use of more or less impure water, is conducive to the burning of tubes. The experience of the Paris, Lyons & Mediterranean Ry. with this type of car has been rather unsatisfactory, because of tube troubles, and the Purrey car is now being adopted in its place.

Komarek Car.—This car is used to some extent by the Austrian State Railway and several of its branches. It is manufactured by F. X. Komarek in Vienna. The following type is representative: Car body, total length, 51 ft.; seating capacity, 35; baggage room, 44 by 96 in.; length of boiler and fuel compartment, 10 ft.; weight, empty, 20 tons; coal capacity, 1,100 lbs.; water capacity, 420 gallons; motor, two-cylinder cross-compound, outside cylinders; cylinders, diameter, 10 by 15 in., stroke 16 in. This car is capable of running at a speed of 25 miles per hour on a level while hauling trailers comprising a total of 50 tons. The operating cost is said to be about 5 cents per train-mile (exclusive of the guard's pay) coal costing $3.25 per ton, made up as follows: Coal, $0.0253; oil, .0014; labor, .0046; maintenance, .0011; driver, .016; total, $0.0484.

Conclusion.

That there is a field for the rail motor car cannot be questioned; its breadth at the present period being limited only by the development of the motor-car power equipment. Steam, as a motive power, has always possessed the distinct advantage of flexibility of control as well as reliability. The internal combustion motor within certain defined limits of horse-power sizes has been developed to that stage of excellence where these advantages cannot be said to apply exclusively to the steam engine. With the experimental work that is being conducted in the development of the internal combustion motor using lower cost fuels than gasolene, and with promising results, who can predict the final outcome of the motive power that will be the most satisfactory from all points of view for the rail motor car? It is probable that both types will have their distinctive fields, depending upon the availability of the fuel.

The report is signed by H. F. Ball (Chairman), F. T. Hyndman, W. R. McKeen, Jr., L. R. Johnson, G. W. Wildin.

TIRE SHRINKAGE AND DESIGN OF WHEEL CENTERS.

The committee was asked to consider the subject, "Distortion of Wheel Centers and Tires Out of Round Due to Heavy Counterbalance." This whole question is so involved that it should be made the subject of a separate committee report. A great deal of work has been done in the past investigating the question of flattening of tires other than by sliding, and apart from the flattening action between the spokes which might result from a thin tire in combination with wheel centers having too light sections of spokes and rim, it does not seem to be particularly a matter which need necessarily be discussed with the shrinkage of tires and design of wheel centers. If the suggestions made by the committee in former years are generally adopted for the section of spoke and rim for cast-steel wheel centers, it will result in eliminating any possibility of distortion taking place from the above-named causes, as it will be generally found that wheels made from these suggestions will be much heavier than many designed some years ago.

The committee renews its recommendations made in 1905 and 1906, and suggests that the whole question covered by its previous reports be referred to letter ballot.

The report is signed by F. J. Cole (Chairman), J. E. Muhlfeld, W. A. Nettleton, D. J. Durrell, W. L. Tracy.

PROPER SPACING OF FLUES IN HIGH-PRESSURE BOILERS.

A circular of inquiry was sent out by the committee and answers were received from 32 members. From the answers received, the majority of the members are in favor of wider bridges than are used at the present time, but no one seems to have made any tests regarding the water circulation between flues or the consumption of fuel, so it is impossible to get data bearing upon these important points. One of the members recommends very strongly a special arrangement, as shown in Fig. 1, an arrangement which has been used successfully for a number of years, but no special tests have been made to determine the efficiency as compared with boilers having the common arrangement of flues, although it is claimed it is a great improvement over the present arrangement in general use. To determine the proper spacing of flues, this subject must be considered from the transportation as well as the mechanical standpoint; that is, the engine failures on account of leaky flues, as well as the cost of maintenance and steaming qualities of an engine, must be considered. The committee is of the opinion that wider bridges, from ⅞ in. to 1 in., or even wider, should be recommended, but before determining exactly what size bridges should be used it would be advisable to make a series of tests to determine the water circulation between flues, the coal consumption for boilers with different size bridges, as well as the cost of maintenance in regard to flues. The committee started several tests to determine the above question in regard to water circulation between flues and the coal consumption, and to ascertain if the same size bridges could be used in both large and small boilers without interfering with the steaming qualities of the engine, but they were unable to continue the tests so that positive data could be obtained on account of unavoidable interference of business. The width of bridges and the necessary reduction in flue heating surface can be determined only by a series of tests to ascertain how far we can go without detriment to the efficiency of the boiler, both in regard to steaming qualities and coal consumption, and at the same time obtain the best results in flue maintenance.

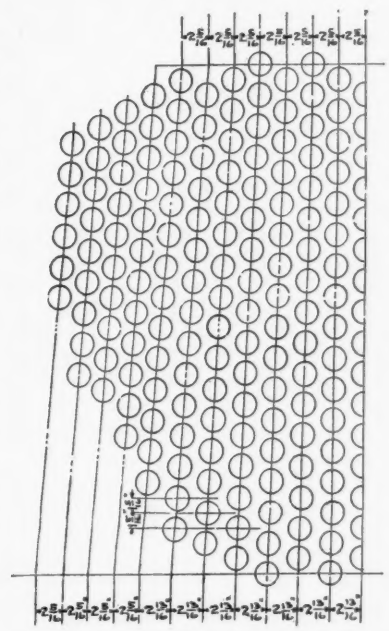


Fig. 1—Flue Spacing in Minneapolis & St. Louis Locomotive Boilers.

The report is signed by C. E. Fuller (Chairman), H. J. Small, T. J. Cole, John Tonge, O. H. Reynolds.

BLANKS FOR REPORTING WORK ON ENGINES UNDERGOING REPAIRS.

Under the present method of making heavy or extensive repairs to engines at one or two main shops, and of making only light or running repairs at the small division shops or terminals, and of running engines out of terminals in either direction in pool service, and where division master mechanics have no regular assignment of engines and, therefore, cannot be held entirely responsible for the condition of engines on their respective divisions, the most important and essential feature in connection with the cost of repairs of locomotives and the results of operation is that of obtaining a correct and accurate report of the condition of engines in service, that they may be sent to the shops best equipped to do the class of repairs which they need, and that the condition of the

engines on the various divisions may be kept consistent with the service required.

In order to assign engines to the shops intelligently, an accurate report of their condition and a comprehensive classification of the repairs required is necessary. The "classification of locomotive repairs recommended by a committee at the last convention, is not well adapted for this purpose. In addition to the classification recommended being complicated, it costs considerable more to make repairs in some cases than in others, though the classification is the same. The most practical and comprehensive classification is the unit classification, based on the estimated cost of repairs, and therefore it is used in connection with the blanks recommended in this report. Under the unit system engines requiring repairs estimated to cost $100 is termed class "1" repairs; $500, class "5" repairs; $800, class "8" repairs; $1,500, class "15" repairs; $3,000, class "30" repairs, etc. Also a more detailed report than the mere classification number (under any system of classification) is necessary in order to intelligently assign engines to the shops for repairs.

In order not to hold engines out of service awaiting room in the main shop, it cannot be left to the discretion of division officials to forward engines to the main shop. They should be assigned to the shops by the head of the Mechanical Department, or one delegated by him to perform this duty. A record of the mileage made by each engine between shoppings and the repairs made to the engines at previous shoppings, as well as accurate reports of the condition of engines and a knowledge of the service required on each division, is essential to intelligently make shop assignments and secure the longest and best possible service at reasonable cost.

The committee recommends the use of the following blanks:

1. Blank showing condition in detail of engines which will require shopping within 30 days. This report is in duplicate form and that part pertaining to the condition of the engine is made by the division master mechanic where the engine is in service and forwarded to the head of the Mechanical Department. The information relative to date, place and class of repairs, and mileage made since last shopping is inserted in the superintendent of motive power's office, and if the shopping is approved the engine is ordered to such shop as best adapted to do the work required and at such time as it can be relieved and space can be assigned it in the shop. The original report will, at that time, be sent to the master mechanic or superintendent of shop to which the engine is assigned for repairs, and the duplicate report filed in the office of the superintendent of motive power as a permanent record. The master mechanic making the report should be held equally responsible with the master mechanic making the repairs for failure to report repairs needed to essential parts, if they are not made.

2. A weekly report to be made by each master mechanic to the head of the Mechanical Department, showing "Engines Turned Out of Shop," with date taken in, date turned out, and class of repairs made; "Engines in Shop," with date taken in, date will probably be turned out, class of repairs, and, if waiting on material, the items, date and number of requisition upon which it is ordered; "Engines Out of Service, Waiting Repairs Account no Room in Shops," with date taken out of service, and class of repairs needed; "Available Track Room in Shop for More Engines," with number of additional engines that can be taken in shop. From these reports a very concise statement can be compiled to be submitted to the heads of the operating department, but a printed form is not desirable for this statement as it can (on account of the varying number of engines in shop) be made on typewriter in more concise form.

3. Blank showing in detail repairs made to the various parts of engines, dates in and out of shop, mileage since last shopping, cost of repairs (with that due to collision and accident shown separately), and other general information which is of interest as a permanent record.

4. Blank showing in detail stay-bolt test and firebox inspection and renewal of stay-bolts. This blank is supplemental to blank 3, and is an essential record which cannot practically be incorporated in blank 3.

5. Blank showing continuous shop record, mileage, cost of repairs of each individual engine. This is a permanent record for use in the superintendent of motive power's office and the information is obtained from reports made on blanks 3, as furnished by the various division master mechanics.

All of the foregoing blanks should be made of loose leaf form, that they may be bound in suitable binders. Blanks 1, 3, 4 and 5 should be bound with engine numbers in consecutive order and each fiscal year in separate volumes. Blank 2 should be bound in order of date.

The report is signed by Theo. H. Curtis (Chairman), E. W. Pratt, C. H. Quereau, F. W. Lane.

HISTORY OF LOCOMOTIVE MOVEMENTS AT TERMINALS.

The committee was instructed to propose a blank form for use at terminals, to give the history of the movement and time of every locomotive from the time of leaving a train until it takes another,

ENGINEMAN'S DAILY REPORT

FOR 24 HOURS, ENDING MIDNIGHT,_____190

DIRECTION (East or West.)								
			TIME ARRIVING.			TIME DEPARTING.		
Train No.	Engine No.	Engineer.	In Yard.	On Ash Pit.	In Round-house.	Leaving Round-house.	Arrived in Yard.	Coupled to Train.
R	S	T	U	V	W	X	Y	Z

Engineman's Daily Report.

the object being to secure closer co-operation between the mechanical and operating departments. A blank is submitted, which is arranged in such a way as to necessitate co-operation in the record itself by rendering it necessary for each department to fill in the items, the control of which lies in its own hands. In this way each department may become conversant with the delays and the reasons for delays for which both departments are responsible.

It is recommended that the roundhouse and the yard shall use the same form, one for each 24 hours. Both the roundhouse and the yard should make its own entries in duplicate—an original and a carbon copy. Immediately at the close of the day, after midnight, the carbon copies may be exchanged and the record completed on each original copy. If sufficient force is available, the records may be combined or completed by a third party. By such a plan close co-operation may be expected.

THE A, B AND C RAILROAD.

DAILY RECORD OF LOCOMOTIVE MOVEMENTS AT_____TERMINAL,

_____DIVISION,

FOR 24 HOURS, ENDING MIDNIGHT,_____190

	ARRIVING.					TO BE READY.				DEPARTING								MECHANICAL DELAY.		TRANSPORTATION DELAY.	
	Train No.	Engine No.	Engineer	Time in Yard.	Time on Ash Pit	Time at Round-house.	Time Order Rec'd.	Promised.	Ready.	Ordered For		Left Round-house.	Arrived in Yard.	Coupled to Train.	Departed.		Engineer.	H. M.	Cause.	H. M.	Cause.
										Train No.	Time.				Train No.	Time.					
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q				
Averages:																					

Daily Record of Locomotive Movements.

In the blank proposed, columns A to F, inclusive, indicate train and engine numbers, the name of the engineer and the time of arrival at the yard, the ash pit and the roundhouse. If necessary, columns may be added to indicate whether the engine is in freight, passenger, switch or work service; but these are not recommended for use where they are not necessary.

Column G will show the time when orders for engines are received. This information may be important in checking the work of the roundhouse. Column H shows the time engines are promised, and column I when they are actually ready. Columns J and K show the number and leaving time of trains for which engines are ordered. Columns L, M and N show when engines leave the

roundhouse, when they arrive in the yard and when they are coupled to trains. Columns O, P and Q indicate the number and time of the departing train; also the name of the engineer. In the remaining columns the delays, both mechanical and transportation, are indicated together with the reasons therefor.

On roads where clerical force is not available it may be desirable to have enginemen supply information for columns A, B, C, D, E, F, L, M and N. For this purpose a small blank form is presented—merely as a suggestion—as a part of this report. One form may be used for arrival as well as departure. For the arrival record the engineer should fill out columns R, S, T, U, V and W. For departure he should fill out columns R, S, T, X, Y and Z. Upon arriving at the ash pit on an incoming engine he should send the blank to the roundhouse, and upon coupling to an outgoing train he should leave another blank with the yardmaster. This information may then be easily transferred to either the roundhouse or the yard record, depending upon whether the engine is arriving or departing.

The committee submits the record form with the recommendation that it be tried experimentally for a year by as many railroads as possible, with a view of gaining opinions from experience upon which to base further action of the Association, and also suggests the advisability of securing the opinions of operating officials concerning such a blank form. It is also suggested that during periods of congestion an energetic man be placed at each locomotive terminal to follow up locomotive delays by aid of this form.

The blank form recommended herein should be understood as offering means for accelerating movements of locomotives when locomotives are greatly needed. Unless acceleration is especially desired, it seems inadvisable to stimulate action on the part of roundhouse forces to hurry the handling, inspection and, more especially, the repair work when there is ample opportunity to take sufficient time to improve the quality of maintenance and inspection and at the same time economize in the cost by eliminating overtime and other irregular work for which a premium must be paid. The committee does not desire to recommend the continuous use of this blank form, except in cases where it may be necessary to increase the activity of terminal operations. Its occasional use to check locomotive service may, however, be exceedingly valuable.

The tendency toward placing an unnecessary burden by exacting unnecessary conditions from either the transportation or the locomotive department should be discouraged. One purpose of this blank form is to enable each department to help the other. It should not be the desire of either the motive power or the transportation department to show the other department that its own work is done and lies waiting. While such a case frequently brings about the desired result, it is an expensive matter for either department to carry on its work in such a way for the purpose of unnecessarily stimulating action on the part of another department.

The report is signed by G. M. Basford (Chairman), H. M. Carson, C. E. Chambers, T. Rumney, J. E. Muhlfeld.

LOCOMOTIVE LUBRICATION.

The subject is divided into four heads:

1. With reference to high steam pressures and superheated steam.

2. How far may we economize in lubrication, both internal and external?

3. The consideration of standard fittings for lubricators.

4. The consideration of sight-feed lubricators versus pumps for internal lubrication.

At the 1906 convention, the committee reported that for locomotives with steam pressures as high as 225 lbs., or those using superheated steam, the temperature of which is as high as 600 deg. F., the ordinary valve oil had been found by experience to be quite suitable, and the problem is one of delivering the oil in proper quantities to the places needing it. This is possible with the modern sight-feed lubricators now in use.

(a) *Internal lubrication.*—Internal lubrication should not be stinted. Dry valves and dry cylinders mean rapid wear of the surfaces of contact in the steam chest and cylinders, also excessive trouble with the valve motion parts. Aside from the increased machine friction, the performance of the engine is affected. Hard-running valves cause a derangement in steam distribution, and worn packing in valve chambers or at rods causes a loss due to leakage. With the slide-valve locomotive there is not so much danger of these troubles, as the jar of the reverse lever attracts attention to the fact that oil is needed and the engineman will see that the valves are properly lubricated. With piston-valve locomotives the internal lubrication may be much below the required amount without any indication from the reverse lever. The engineer on a slide-valve engine, even on a small allowance of oil, is more apt to keep the valves supplied with enough oil to prevent hard service to the machine, while with piston-valve engines he is not so able to tell that the valves need oil, and no one knows that the parts have been running too dry until trouble comes through heated bearings and worn or broken parts. For internal lubrication, 70 miles per pint for large freight locomotives and 80 miles per pint for large passenger locomotives seems to be the amount needed to lubricate properly. The amount to each class depends upon the speed at which the locomotive is running; in bad water districts the oil allowance should be increased about 25 per cent.

(b) *External lubrication.*—The use of grease on crank pins and driving axles offers the best solution of how to decrease the cost of external lubrication and at the same time secure the best results. In reference to the cost of external lubrication as compared with that of four years ago, the cost per square inch lubricated, or per pound carried, is less with the use of hard grease than when oil was in general use.

The committee's recommendations as to standard fittings for locomotives were referred to letter ballot in 1906 and are now standards of the Association.

A well-designed sight-feed lubricator, that has pipe connections suitably arranged so as to deliver the oil in the most direct way to the parts needing it, will under present conditions do the work properly. On superheated locomotives it is generally conceded that there should be one pipe from the lubricator leading direct to the cylinders and attached to separate plugs near the center, so that the oil fed from the lubricator, for the cylinder, may be properly distributed. The question of location of plugs in the steam chest is one point on which there is considerable difference of opinion; one member of the committee, who has had considerable experience with superheated steam, favors putting the steam chest plugs at the end of the valve chest in preference to attaching the oil pipe to the center of the chest and letting the oil be carried by the steam to the parts where needed. The committee as a whole believes that the question of locating steam chest connections is one that can be left open and, therefore, does not make any recommendations.

The report is signed by D. R. MacBain, R. D. Smith, R. F. Kilpatrick, C. Kyle, W. O. Thompson.

RESULTS OF USE OF DIFFERENT VALVE GEARS ON LOCOMOTIVES.

By far the greater number of engines in this country are equipped with the Stephenson link motion. This is probably true also, but in a less degree, in the British Isles, but on the continent of Europe the Walschaert motion leads all others. The Stephenson link motion has held its own in this country, almost without consideration being given to other types, until within very recent years. The types and weights of engines employed lent themselves to convenient use of the link motion which has many desirable and valuable features to commend it. The time came, however, when it became expedient to make changes for the following reasons: Some types of engines have so many wheels or they are so closely grouped that it is a difficult matter for engine men to get under them except when over a pit. This contributes to neglect, lack of prompt adjustments for wear, lack of proper inspection and a more rapid deterioration. With the increase in size and weight, the dimension of eccentrics required for large axles are excessive and their peripheral speed is so great as to make maintenance and lubrication of the eccentrics and straps expensive and troublesome.

By the abolition of eccentrics and straps, a long list of engine failures is eliminated; expense for maintenance and lubrication reduced; room gained for better cross-bracing and strengthening of frames and adding to convenience on account of men not being required to go under engines to the same extent. On heavy engines, the weight of all moving parts of a link motion, from the eccentric straps through to the valves, is so great as to contribute to accident and rapid wear so that an equally efficient valve motion with lighter parts and greater accessibility is in demand for heavy power.

For many reasons, we cannot lower the standard of efficiency as set by the Stephenson link motion. Economy in the use of coal and water are more necessary than a reduction in weight and wear of valve motion parts. No railroad manager will sanction the use of a device, no matter how simple it may be, if his costs as measured in coal are increased thereby. Fortunately, we are able to obtain a valve motion having the desirable features of lighter parts and accessibility without a loss of efficiency in the Walschaert motion, which has come into extensive use the last few years.

The report does not describe the arrangement and detail of these motions, but presents some valve motion diagrams and data furnished by the courtesy of the American Locomotive Company and the Baldwin Locomotive Works, comprising recent examples of both Stephenson link and Walschaert motions. (Not reproduced.—ED.)

The Baldwin Locomotive Works has recently developed a machine which may be quickly attached to an engine for the purpose of obtaining a valve motion diagram. Used in this way, the results obtained show also the effect of spring and of all lost motion in the valve-moving mechanism. Two sets of diagrams drawn by this machine on similar engines, except as to their valve motion, show that the Stephenson motion, with 2.45 in. valve travel, gives about the same results as the Walschaert motion with 2 in. travel. These diagrams clearly show the fact, that, notwithstanding the constant lead of the Walschaert motion, the preadmission is more favorable at short cut-offs than with the Stephenson motion. The

various points of preadmission, port openings, equalization of cut-offs, release and the closures can be as favorably arranged with Walschaert motion as with the link motion examples presented.

The following tables of weights are given for 22-in. consolidation engines built by the Baldwin Locomotive Works, and said to be identical in everything except the valve motion:

	Complete moving and structural parts		Moving parts only.	
	Stephenson.	Walschaert.	Stephenson.	Walschaert.
Crossheads	676	746	676	746
Guide bearer	814	1,116	...	...
Guides	1,712	1,712	...	...
Eccentrics	600	...	600	...
Crank arms	...	250	...	250
Eccentric straps	1,100	...	1,100	...
Main crank pins	520	516	520	516
Links	238	418	238	413
Reverse shaft	325	655	325	655
Rockers and boxes	618	730	618	730
Rocker rods and hangers	169	...	169	...
Link bearing	...	234	...	...
Eccentric rods	184	264	184	264
Valve rods	220	546	220	546
Valve yokes	154	140	154	140
Valve rod guide	24	28	...	...
Complete set	7,354	8,321	4,804	4,265

While the engine with Walschaert motion weighed 1,000 lbs. more than the other one on account of the motion, yet the weight of the moving parts was less. The *American Engineer and Railroad Journal*, June, 1905, published some figures showing saving of weight by the use of Walschaert motion on L. S. & M. S. engines, as follows: 1,283 lbs. on a consolidation, 1,215 lbs. and 1,745 lbs. respectively on two classes of Prairie type engines. These figures indicate a larger saving than the foregoing example, but it is possible that as these were early developments, they may not be representative of present successful practice. Similar valve motion parts on engines abroad are very much lighter than we dare use in our own practice. It seems fair to conclude, therefore, that we may yet look for improvement in this respect.

The matter of lead has received much attention, particularly with link motion, but, as a matter of fact, the measured full gear lead is only used possibly for a few turns of the wheels in starting the engine, and when running notches are in use the lead is entirely different, the amount being dependent upon various conditions. As the running notch leads for best results are within narrow limits, it is apparent that the full gear leads vary within a wide range. The amount of full gear lead is therefore of little importance in the operation of the engine if the running notch lead is right. If these premises are correct, then there can be no argument as against the constant lead characteristics of the Walschaert motion, provided the lead is the proper amount for the running notches. The valve motion diagrams show that all the other events as derived by a link motion can be duplicated by the Walschaert motion so that, except in so far as the lead is concerned, equivalent operation can be obtained; hence, equivalent economies.

The practical operation of Walschaert motion is best shown by the testimony of roads using it in considerable numbers, and at a recent meeting of motive power officers and locomotive builders held to discuss the results of the use of Walschaert motion engines, the roads represented having about 1,000 such engines, it was the unanimous opinion that Walschaert motion was equally well adapted to fast and slow passenger and freight service; that equivalent economies in fuel and water were obtained; that no reductions of tonnage ratings were necessary; that expense of maintenance and repairs were reduced; that inspection and repairs were facilitated; that construction advantages in the way of frame-cross bracing, etc., were increased; that valve adjustments made are maintained and engines kept square much longer on account of the motion being more direct, rigid and positive for the passage of the valve-driving stresses; and that convenience of the enginemen, inspectors and shop men is promoted by the accessibility of the motion.

There are also available for the use of railroads some patented forms of valve motion or systems of steam distribution which are claimed to obtain economies superior to those of the types already mentioned. The Young valve gear has been applied to engines with Stephenson link and later a Walschaert motion having some detail modifications from the regular design has been proposed. The motion acts upon a wrist plate which has connections to two semi-rotary valves, and the effect of the combination produces valve events remarkable on account of absence of preadmission, small amount of lead, quick port opening, large exhaust area and fine equalization of the events. It is claimed, due to these features, that fine performance and superior economies are obtained which more than compensate for the cost of maintenance of additional parts required.

For the past six years, the Allfree-Hubbell designs for improving steam distribution have been under test and the designers have made changes from time to time as to them seemed best. The first design or "geared system," as the designers called it, has been superseded by what is known as the "compression system," which has been in service for several months. This design is supposed to embrace the economic features of the original design with some additions, and, as it now stands, it attempts to produce the following results: late release, late compression, low clearance, balanced compression, reduced cylinder radiation, quick admission and quick release. In the later design an auxiliary valve has been introduced for the control of compression alone, and allows the main valves to be made and set for a desired release with the Stephenson link, Walschaert, or any other motion, all the changes being made in the cylinders and valve alone.

This device has been under test on several roads and from an average of several reports it seems to give about 6 per cent. reduction in fuel consumption and 5 or 6 per cent. increase in train load, and is able to maintain the same or a little more speed than engines of the same size and ordinary design, except the cylinders. There is also a lighter drain on the boiler for steam, but we are unable to express the amount in figures.

In making a study of this system for causes of the results claimed, we find a very late compression, which, according to the argument of the designers, means that the negative working pressure is acting at a time when it produces the least effect on crank pin. In other words, when the crank pin is very near the center, from this point alone, an increased load is possible, not so much from an increased working pressure as from a reduced negative work. In view of the above argument, any given load could be handled with a less amount of steam, which means a less amount of coal and therefore brings the handling of greater load within the possibilities of the boiler. In addition to this, the reduced clearance is claimed to be responsible for a considerable steam economy.

The report is signed by C. A. Seley (Chairman), R. Quayle, L. H. Turner, J. H. Manning.

Exhibits at the Atlantic City Conventions.

The exhibits at this year's conventions of the Master Car Builders and Master Mechanics Associations have again been placed on the Steel Pier. While the number of exhibitors this year is 285 compared with 254 last year the total floor space occupied is considerably less, 55,500 sq. ft. as against 66,350 sq. ft. last year. The erection and decoration of booths and exhibit spaces has been placed in the hands of one contractor and an artistic and uniform scheme has been worked out. In addition to the exhibitors on the Steel Pier the Goodwin Car Co., Hicks Locomotive & Car Works, Modoc Soap Co., and St. Louis Car Co. have track exhibits near the Pennsylvania Railroad station at the foot of Virginia and Mediterranean avenues. A partial list of the exhibits follows and the remainder will be printed in another list next week.

Adams & Westlake Co., Chicago.—Adlake acetylene gas car lighting system; railroad lanterns; non-sweating, down-draft signal lamps; car hardware, and gas and electric chandeliers. This company also has an exhibit truck, consisting of a demonstration of the Newbold system of electric car lighting from the axle.

Addressograph Co., Chicago.—The card index "Addressograph," combined addressing machine and complete card index system.

American Balance Valve Co., Jersey Shore, Pa.—Balanced slide and piston valves for pressures up to 250 lbs., including piston valves after two years' night and day service passing over ports without bridges; models of the Walschaert valve gear and of a modified Stevens gear, the latter including an internal admission, double-acting Wilson valve at each end of the cylinder.

American Blower Co., Detroit, Mich.—Blowers, ventilators, motor-driven air compressor.

American Brake Shoe & Foundry Co., Mahwah, N. J.—Steel back, wrought lug brake shoes for locomotives, coaches and freight cars.

American File Sharpener Co., New York.—American file sharpening machine; "Carboflynt" for sharpening files.

American Mason Safety Tread Co., Boston, Mass.—Lead and carborundum safety treads for car steps, stations, etc.

American Steam Gauge & Valve Mfg. Co., Boston, Mass.—Locomotive steam specialties, such as muffled pop safety valves, steam gages, duplex gages, chime whistles, American dead weight gage tester, American Thompson improved indicator, etc.

American Steel Foundries, Chicago.—Cast-steel locomotive frames; cast-steel driving wheel centers; Simplex brake-beam; Simplex driving wheel and coach springs; Simplex car and tender bolsters; cast-steel bolsters; cast-steel side rods and crossheads; Janney cast-steel coupler; the Davis cast-steel car wheel; Susemihl roller-side bearings; Andrews cast-steel side frame; and spring controllers; Kelmont passenger and freight coupler; Leeds pilot coupler and American Steel Foundries Co.'s complete truck mounted in turntable in motion; spring controllers and spring seats.

American Water Softener Co., Philadelphia.—Complete working model of an American water softener.

Anglo-American Varnish Co., Newark, N. J.—Varnishes.

Armstrong Brothers Tool Co., Chicago.—Various designs of tool holders, "Universal" ratchet drills, planer jacks, tool posts, lathe dogs and boring tools.

Atha Steel Castings Co., Newark, N. J.—Cast-steel truck bolsters; "Titan" manganese steel motor gears.

Baeder, Adamson & Co., Philadelphia, Pa.—Large model of refrigerator car, showing hair-felt insulation.

Barnett Equipment Co., Newark, N. J.—Demonstration of the Barnett Connector automatically coupling the steam heat, signal and air-brake service and safety hooks (in lieu of safety chains) between cars; also Barnett universal steam hose coupler.

Besly, Chas. H., & Co., Chicago.—Spiral-grooved steel grinding disks; heavy spiral cloth and paper circles; Helmet tempered taps; Helmet babbitt; Helmet oil, and Helmet bronze, spring and sheets.

Best, W. N., American Calorific Co., New York.—Oil furnaces for annealing, brazing, heating, etc.; also oil burners and safety regulator cocks.

Bethlehem Steel Co., South Bethlehem, Pa.—Staybolt iron, high speed steel, special alloy steel, rails, heavy machinery and special structural shapes.

Bettendorf Axle Co., Davenport, Ia.—Bettendorf 40-ton capacity structural steel underframe equipped with Bettendorf all cast-steel trucks and cast-steel center sill ends; I-beam body and truck bolsters of 30, 40 and 50-ton capacity; trucks of 30, 40 and 50-ton capacity; removable journal box truck frame and riveted arch bar truck frames.

Bickford Drill & Tool Co., Cincinnati, Ohio.—Standard plain radial drill in operation with variable speed motor drive.

Birdsboro Foundry & Machine Co., Birdsboro, Pa.—Jackson belt lacing ma-

chine, Wagner universal cold saw machine, Disston's Premier inserted-tooth metal saw.

Bliss Electric Car Lighting Co., Milwaukee, Wis.—The Bliss constant potential bucker electric train lighting system; Bliss, N. Y. C., constant potential booster system; Bliss, Santa Fe, constant current system; also standard batteries.

Bordo, L. J., Co., Philadelphia, Pa.—Blow-off valves, hydraulic valves and swing joints for locomotive and tender connections, double seated gage cocks.

Bowser, S. F., & Co., Fort Wayne, Ind.—Oil house equipment for railroads and factories; also shop tanks, cabinets, lubricating oil tanks, self-measuring oil tanks, power pumps, etc.

Bradford Draft Gear Co., Chicago.—Four-spring and three-spring draft gears, rocker bottom cars and air-brake connectors.

Brady Brass Co., Jersey City, N. J.—Cyprus bronze locomotive castings and bearings; Cyprus bronze journal bearings; motor bearings for electric railways; babbitt metal solder, brass castings, trolley wheels; battery zincs and phosphor bronze.

Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.—Locomotive guide bar motor driven grinder in operation; emery wheels and motor-driven plain grinder.

Buch's, A., Sons Co., Elizabethtown, Pa.—Literature describing gravity molding machine.

Buckeye Steel Castings Co., Columbus, Ohio.—Major coupler for freight cars; Ohio passenger coupler; also the Buckeye cast-steel yoke, adapted for any and all kinds of draft gears.

Buda Foundry & Mfg. Co., Chicago.—Buda car replacers; Paulus drill; Buda ball-bearing jacks; Buda ratchet car jacks; Buda lining-up track jacks; Buda improved reinforced tread hand car wheel; Buda drill grinder; car replacing ball-bearing jack.

Buffalo Brake Beam Co., Buffalo, N. Y.—Buffalo brake beams; forged steel brake heads; forged fulcrums; forged chain clips; forged wheel guards, and steel backs for brake shoes.

The Bullard Machine Tool Co., Bridgeport, Conn.—A 36-in. vertical turret lathe in operation.

Cardwell Mfg. Co., Chicago.—Cardwell friction draft-gear and Cardwell rocker side bearings.

Carey, Philip, Mfg. Co., Lockland, Cincinnati, Ohio.—Plastic freight car roofing; magnesia flexible cement roofing; locomotive boiler lagging; train pipe covering; roofing paints, and magnesia and asbestos goods of all kinds.

Chicago Car Heating Co., Chicago.—Full-sized models of the vapor system of car heating, in operation; also steam specialties.

Chicago Pneumatic Tool Co., Chicago.—Franklin air compressor; Turbine air drill; Boyer and Keller pneumatic hammers; Boyer, Keller and Little Giant pneumatic drills; improved high-speed Little Giant drills; Duntley air-cooled electric drills; portable and tool post grinders; blowers; hoists; "Magnetic Old Man"; drilling stands; electric compression riveter; Duntley vacuum portable house-cleaning device.

Chicago Railway Equipment Co., Chicago.—The "Monitor" car bolster; National Hollow, Creco, Diamond, Kewanee, Reliance, Monarch, "96," and Sterlingworth brake beams; Creco roller-side bearings, and the "Creco" journal box and lid; also Creco slack adjuster.

Clark, A. C., & Co., Chicago.—Models of Clark mechanical boiler cleaners.

Cleveland Pneumatic Tool Co., Cleveland, Ohio.—Reversible and non-reversible air drills; wood boring machines; pneumatic chipping, calking, beading and riveting hammers; pneumatic drift-bolt drivers; Bowers hose-coupling, and plain and armored air hose.

Cling-Surface Co., Buffalo, N. Y.—Device for demonstrating the difference in efficiency between a belt treated with "Cling-Surface" and running slack as compared to a belt untreated running tight.

Coe Brass Mfg. Co., Ansonia, Conn.—Patent extruded brass in step nosings, step treads and platform bindings; car door, window and eave moldings; architectural and automobile moldings; special shaped bars and rods and extruded metal in various forms to supersede castings.

Coe, W. H., Manufacturing Co., Providence, R. I.—Coe's gilding wheels and ribbon gold leaf; "Hieburnish" bronze powders and bronzing liquid.

Columbia Nut & Bolt Co., Inc., Bridgeport, Conn.—Columbia lock nuts being exhibited by the U. S. Metal & Manufacturing Co., railroad sales agents for the Columbia company.

Commercial Acetylene Co., New York.—Acetylene gas lighting fixtures and apparatus for the storage of acetylene gas in cylinders filled with porous substance and acetone; also acetylene locomotive headlight; locomotive marks; yacht searchlight and portable table lamps; also tank cut open, showing asbestos packing.

Commonwealth Steel Co., St. Louis, Mo.—Models of Transom draft gear for wooden and steel cars; separable body bolster for steel and wooden cars; Davis locomotive wheel; cast steel tender and engine truck; also the tire-graph machine.

Consolidated Car Heating Co., Albany, N. Y.—Steam car heating apparatus; automatic steam couplers; automatic traps; heavy valves and fittings; electric heaters; regulating switches, and the McElroy automatic axle lighting system shown in operation.

Consolidated Railway Electric Lighting & Equipment Co., New York.—"Axle Light" system for electric car lighting, showing new type "D" dynamo running at all speeds without variation in current output or voltage, the current and voltage being controlled by the new "Kennedy" regulator.

Curtain Supply Co., Chicago.—Forsyth No. 86 roller tip fixtures; "ring" fixtures; eccentric fixtures; also a full line of curtain materials.

Davis Solid Truss Brake Beam Co., Wilmington, Del.—Brake-beams for freight and high-speed passenger service. A special brake-beam testing machine in operation.

Dearborn Drug & Chemical Works, Chicago.—Boiler compounds; anti-foaming compounds for locomotives; vegetable water treatment for locomotive boilers; and samples of tubes, showing action of alkali.

Detroit Hoist & Machine Co.—Full sized sample of locomotive turn-table pneumatic mule in operation; also geared pneumatic hoists.

Detroit Lubricator Co., Detroit, Mich.—Locomotive lubricators having three, four, five and seven feeds.

Detroit Seamless Steel Tube Co., Detroit, Mich.—Seamless steel locomotive flues and safe ends.

Dickinson, Paul, Inc., Chicago.—Cast-iron engine-house smoke jacks; also cast-iron ventilators and chimneys.

Dill, T. C., Machine Co., Philadelphia, Pa.—15-in. Dill slotting machine with variable speed motor drive in operation.

Dixon, Joseph, Crucible Co., Jersey City, N. J.—Steel structure painted with Dixon silicate graphite paint; graphite lubricants, pencils, foundry facings, greases and crucibles.

Dressel Railway Lamp Works, New York.—Headlights; latest design of train tail-marker lamps and engine signal lamps; gage lamps, engine cab lamps, etc.

G. Drouve Co., The, Bridgeport, Conn.—Examples showing the Lovell window operating device and the "Anti-Pluvius" skylight; also models of different styles of skylights.

Dudgeon, Richard, New York.—Thirty-ton universal jacks of the railroad, plain, claw and independent types; 40-ton universal railroad jack and 60-ton independent pump universal jack; circulars describing the full line of universal jacks.

Duff Mfg. Co., Pittsburg, Pa.—Various types of Barrett and Duff track and car jacks.

Edwards, The O. M., Co., Syracuse, N. Y.—Window fixtures; vestibule trap doors, and tin barrel spring rollers for curtains; samples of metal windows and window sash; also samples of new designs of car windows.

Electric Storage Battery Co., Philadelphia, Pa.—Latest types of "Chloride Accumulator" for car lighting, signal service, etc.; sample of accumulator used in New York Central electric zone sub-stations.

Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio.—Hollow staybolt bars of various diameters in 10-ft. lengths; also samples of raw materials from which the bars are rolled.

Farlow Draft Gear Co., Baltimore, Md.—The Farlow draft gear as applied on cars of the Great Northern and Seaboard Air Line; on Atlantic Coast Line cars in connection with the Westinghouse friction barrel, and another in connection with Sessions friction barrel; twin spring gear as applied to malleable iron draft sill casting and to channel sills for wooden underframe; also gear cut from a wrecked steel car; also cast-steel end sills with Farlow draft gear slots cast in same.

Flannery Bolt Co., Pittsburg, Pa.—The Tate flexible staybolt and special tools for applying the same.

Flexible Compound Co., Philadelphia, Pa.—Fabrics, wood and metal, covered with "Flexible Compound" and tested in acid; other demonstrations and tests of Flexible Compound mixed with paint and of Flexible Black Enamel.

Foster, The Walter H., Company, New York.—Lassiter staybolt threading and reducing machine; grinding machines for grinding piston rods, chasers and tools; Landis double head bolt cutter; also exhibiting photographs for the Gisholt Machine Co.

Fox Machine Co., Grand Rapids, Mich.—Fox universal wood trimmers; adjustable saw dado or grooving heads, mitre machines, heavy pipe or flue cutting machines; hand and power feed milling machines; pattern maker's bench with Emmert vise; power core box machine.

Franklin Mfg. Co., Franklin, Pa.—Corrugated asbestos roofing and sheathing; asbestos building lumber and "Century" shingles; "Ambler" asbestos packing; K. & M. 85 per cent. magnesia locomotive lagging; asbestos packing, textiles, pipe covering, roofings and lumber smoke jacks. Furnished the asbestos building lumber for covering Steel Pier.

Franklin Railway Supply Co., Franklin, Pa.—McLaughlin lock nuts, McLaughlin metal flexible conduit, Franklin driving-box lubricator; Franklin pneumatic fire-door openers; Franklin metal ball joint; demonstration of Hill's new method of applying bearing metal to journal boxes.

Frost Railway Supply Co., Detroit, Mich.—The Harvey friction draft spring shown as applied to the Butler, Farlow, Adjustable and Monarch draft gears.

Galena-Signal Oil Co., Franklin, Pa.—Reception booths on pier.

Garlock Packing Co., Palmyra, N. Y.—Full line of fibrous and metallic packings for locomotive and general railroad use.

Garvin Machine Co., New York.—Universal milling machine; vertical spindle milling machine; die slotting machine; automatic tapping machine; motor-driven plain milling machine in operation.

Gold Car Heating & Lighting Co., New York.—Electric, hot water, steam and refrigerator car heating apparatus; acetylene car lighting system.

Goldschmidt Thermit Co., New York.—Samples of steel welded by the Goldschmidt process; also samples of metal and different designs of patterns, molds and flasks used in making welds; also new designs of fire brick molds; demonstrations of welding locomotive frames; samples of chromium, manganese, molydenum, etc.

Green, Tweed & Co., New York.—Palmetto packing and the Favorite reversible wrench and the "Exacto" packing gage and cutter.

Hale & Kilburn Manufacturing Co., The, Philadelphia, Pa.—Full line of car seats for all service, including heavy electric cars; "Neverbreak" pressed steel, "Walkover" seats, all steel and fireproof unholstered seats, reclining and revolving parlor car seats.

Hammet, H. C., Troy, N. Y.—Trojan metallic packing; Sansom pneumatic bell ringer; triple valve bushing roller.

Hammond Typewriter Co., Philadelphia, Pa.—Hammond interchangeable type typewriters of various sizes, including a special close space machine for tabulating work, and a "Bichrome" machine, writing in two colors.

Hanlon Locomotive Sander Co., Winchester, Mass.—Locomotive sand box with Hanlon sander attached.

Hanna Engineering Works, Chicago, Ill.—Two compression yoke rivetters; electric screen shaker; pneumatic screen shaker and models showing rivetter motion.

Harrington, Edwin, Son & Co., Inc., Philadelphia, Pa.—Differential, screw and spur-geared chain hoists; geared and plain travelers and a staybolt threading machine.

Harrison Dust Guard Co., Toledo, Ohio.—Harrison dust guard; driving box, cellar and car journal lubricators; driving box cellars; Williams-Harrison journal boxes.

Harrison-Williams Co., Toledo, Ohio.—See Harrison Dust Guard Co.

Heath & Milligan Mfg. Co., Chicago.—Reception space.

Helwig Mfg. Co., St. Paul, Minn.—Pneumatic staybolt chippers; pneumatic hammers; reversible pneumatic end spindle drill motors; portable pneumatic grinders and self-feeding flue expanders.

Hicks Improved Engine Brake Co., Atlanta, Ga.—Hicks improved engine brake in operation.

Hicks Locomotive & Car Works, Chicago, Ill.—Photographs of works, officers, and of cars and locomotives built by the company; also samples of wood used in private cars.

Hitner, Henry, Sons & Co., Philadelphia, Pa.—Various types of plate washers.

Homestead Valve Mfg. Co., Pittsburg, Pa.—Homestead locomotive blow-off valves.

Houghton, E. F., & Co., Philadelphia, Pa.—Hydro carbonated bone black for case hardening; tempering oil; cutting oil; cutting compound; lubricating grease; adhesive belt dressing; oil filter; "Cosmic" counter-corrodent; "Vim" air brake leathers; hydraulic leathers and cylinder oils; "Cosmolubric" engine oils; "Marek" steam trap.

Hunt-Spiller Mfg. Corporation, Boston, Mass.—Hunt-Spiller gun-iron castings for locomotives, such as eccentrics, eccentric-straps, cylinder bushings, cylinder packings, pistons, piston valve packing, piston-valve cages, driving boxes, driving-box shoes and wedges, cross-head shoes and gibbs, superheater headers, gears, etc.

Independent Pneumatic Tool Co., Chicago.—"Thor" pneumatic drills, reaming, tapping, wood boring and flue rolling machines; end spindle corner drill; hammers; turbine wood saws, etc.

Indestructible Fibre Co., Massena, N. Y.—"Fibrite," "Durite" and "Kantlite" car head linings; also indestructible fibre tiling.

Jenkins Brothers, New York.—Complete line of iron and brass valves; also packings and tubings.

Johns-Manville, H. W., Co., New York.—"Vitribestos" smoke jacks and pipe covering; Portland sectional conduit; train pipe coverings; asbestos roofings; steam and sheet packings; fire felt, and cement felting; "Vulcabeston" packings; 85 per cent. magnesia cement and locomotive lagging; 80 per cent. magnesia train pipe covering; "Asbesto-sponge" felted sectional pipe covering; air pump packings; "Asbesto-metallic" flange gaskets; fire resisting cements; electrical insulating materials; "Noark" fuses; fire extinguishers; refrigerator and produce car insulating materials; "Perolin."

Justice, Philip S., & Co., Philadelphia, Pa.—Reliance hydraulic jacks and Justice spike puller.

Kalamazoo Railway Supply Co., Kalamazoo, Mich.—Pressed steel hand and push car wheels; Moore track drills; Root locomotive scraper and flanger, and Kalamazoo ratchet jacks.

Kelly-Arnold Mfg. Co., Inc., Wilkesbarre, Pa.—Automatic air and steam connectors for passenger cars; automatic air connectors for freight cars; automatic device for detaching connector from coupler; auxiliary connections for gum hose.

Kent, Edwin R., Co., Chicago.—Allen's "Air-hardening" high-speed tool steel and high-speed twist drills, flat drills, reamers, etc.; also aluminum models of manganese frogs and crossings; also samples of the ingredients used in making this steel.

Keystone Drop Forge Works, Philadelphia, Pa.—Drop forgings for car and locomotive work, including Keystone connecting links, safety shackle hooks.

Keystone Lubricating Co., Philadelphia, Pa.—Keystone lubricating grease in various densities; demonstrations of general engine lubrication and shafting lubrication.

Kinnear Mfg. Co., Columbus, Ohio.—Full size wood rolling roundhouse door and full size steel rolling freight house door.

Landis Tool Co., Waynesboro, Pa.—No. 1½ universal grinding machine with automatic feeds; No. 16 gap grinding machine; also samples of work.

Lang, G. R., Co., Meadville, Pa.—Lang's T bolt heads.

Lawrence Mfg. Co., Philadelphia, Pa.—The Filion folding vestibule trap; "Anti-waste Grabber."

Livezey, John R., Philadelphia, Pa.—Representing the Armstrong Cork Co.,

Pittsburg, and the Norristown Magnesia & Asbestos Co., Norristown, Pa. Sheet and granulated cork for cold storage work and refrigerators; cork pipe coverings, electric insulation and floorings; models of cold storage construction; asbestos aircell pipe coverings.

Locomotive Stoker Co., The, Chicago.—The W. H. Strouse automatic locomotive stoker.

Lodge & Shipley Machine Tool Co., Cincinnati, Ohio.—No. 24 patent head lathe in operation, driven by variable speed motor.

Lord, Geo. W., Co., Philadelphia, Pa.—Full line of samples of boiler compounds.

McConway & Torley Co., Pittsburg, Pa.—Janney freight couplers; Kelso freight couplers; Pitt freight couplers; Kelso tender couplers; Kelso pilot couplers; Janney passenger car couplers, and Buhoup 3-stem coupler; the Buhoup 3-stem coupler applied to standard steel platform; also Janney "X" freight coupler.

McCord & Co., Chicago.—McCord journal boxes, draft gear, spring dampeners and force feed locomotive lubricators; McKim gaskets.

Mason Regulator Co., Baston, Mass.—Reducing valves for locomotives, stationary and marine engines; regulators, governors, belt shifters and steam pumps.

Merchant & Evans Co., Philadelphia, Pa.—Fire retarding "Star" ventilator; also tin plates, babbitt metals and other special metals for railroad use.

Michigan Lubricator Co., Detroit, Mich.—New type of double, triple, 5- and 7-feed sight feed lubricators, with the sight-feed glasses around the oil reservoir as well as on top; also a new patented automatic drain stem which drains the water from the lubricator and closes automatically, thus avoiding the loss of oil.

Nathan Mfg. Co., New York.—Monitor, Simplex and new Nathan injectors, both lifting and non-lifting; "Bullseye" and "1899" lubricators, 2, 3 and 6 feeds; reversible stop boiler check valve; "Phillips" double-safety boiler check; Coale muffler and safety valve; Klinger reflex water gage; other locomotive fittings, including whistles, strainers, cocks, valves, etc.

National Brake & Electric Co., Chicago.—Portable motor-driven air compressor, on steel frame truck, in operation; sectional motor-driven air compressor; engineer's valve; emergency valve; also oil pneumatic governor.

National Lock Washer Co., Newark, N. J.—Full line of samples of nut locks; full size models showing operation of curtain fixtures, car curtains, sash locks, sash balances and window fixtures.

National Patent Holding Co., Chicago.—National hot water boiler washing and filling system; White sectional boltless piston head; Atlas frictionless center and side bearings; National safety boiler plate clamps; samples of case hardening done by National case hardening compound.

Newman Clock Co., Chicago.—Samples of Newman watchman's clocks.

New York Air Brake Co., New York.—Forsyth automatic connector in operation.

New York Flexible Metallic Hose & Tubing Co., New York.—Flexible metallic hose for air-brakes, car heating, pneumatic tools, shop use, water, gas, fuel, oil, etc; flexible armored lead pipe; expansion joints; "Sirocco" apparatus for blowing out boiler flues; "BBBB" Balata belting; "Steuerrad" packing; "Nyflexmet" flexible metallic dredging sleeves.

Norton, A. O.—Boston, Mass.—Full line of Norton ball-bearing jacks.

Norton Co., Worcester, Mass.—Alundum grinding wheels and specialties, including Alundum grain for polishing; India oil stones.

Norton Grinding Co., Worcester, Mass.—Car wheel grinder in operation, with indicators showing variation from true as the work is being done; also a grinding machine for piston rods and axles.

Norvell Shapleigh Hardware Co., St. Louis, Mo.—"Diamond Edge" tools, including axes, saws, augers, files; also line of shovels and scoops, showing evolution of "One-piece" Conqueror shovel.

Ohio Brass Co., Mansfield, Ohio.—Tomlinson automatic radial car coupler; Nichols-Lintern supplementary sander valve; Lintern car signal system in operation.

Pantasote Co., New York.—Pantasote car curtains and seat fabrics.

Parker Anti-Freezing and Hot Water System, London, Ont.—The Parker system of car heating.

Pels, Henry, & Co., New York.—No. 4 hand power punch; bar shear; beam shear; plate shear.

Penn Steel Casting & Machine Co., Chester, Pa.—Cast-steel locomotive cylinder, subjected to a ballistic test; high pressure valves tested hydrostatically, and other steel castings.

Perry Side Bearing Co., Chicago.—Perry roller side bearings; also bearings after four years' service.

Phillips, F. R., Sons & Co., Philadelphia, Pa.—Laffitte welding plates; brazing, tempering and welding powders; "Velos" high speed twist drills and steel.

Pilling Air Engine Co., Detroit.—See Detroit Hoist & Machine Co.

Pittsburg Automatic Vise & Tool Co., Pittsburg, Pa.—A 650 lb. double swivel solid rear jaw vise and a 725 lb. double swivel back jaw vise, each with 15 in. opening; also a variety of vises for woodworkers, pipe fitters, heavy railroad shop use, automobiles, etc.

Pittsburg Equipment Co., Pittsburg, Pa.—Cast steel side frame for deep truss bolster; cast steel column casting; cast steel interlocking spring plank; built-up rolled steel and cast steel truck bolster; twisted cast steel spindle broken in service; models of cast steel combined body bolster and draft carrier and of a three-piece cast steel side frame; perspective drawing of Hennessey cast steel body bolster for steel underframe cars.

Ralston Steel Car Co., Columbus, Ohio.—Model of steel underframe; also model of steel drop bottom dump car.

Refined Iron & Steel Co., Pittsburg, Pa.—Samples of iron showing heat and cold tests and fractures.

Republic Railway Appliance Co., St. Louis.—Republic friction draft-gear.

Restein, Clement, Co., Philadelphia, Pa.—Packings, including Belmont locomotive throttle and air pump packings; air pump tank hose and Belmont steam hose.

Rockwell Engineering Co., New York.—Oil furnaces for railroad shop use, including furnaces for bolt and rivet heating, flue welding, brass melting, forging, etc.

Rutherford Automatic Connector Co., Chicago.—Full size sample in operation of Rutherford automatic air, steam, and air signal connector.

Rund Mfg. Co., Pittsburg, Pa.—Automatic gas water heaters and storage heaters.

Ryerson, Jos. T., & Son, Chicago.—Lennox beveling shear in operation; Simplex track and car jacks; Ryerson's portable key-seating machine; model of Ryerson's flue-cleaning machine; Cleveland vertical solid frame punch; working model of Continental boiler with Morison corrugated furnaces.

Safety Car Heating & Lighting Co., New York.—"Standard" system of steam heating. Models showing the system as applied to passenger cars; also various parts of the apparatus cut out to show construction. Safety steam coupling; also has an exhibit of modern lamps for car lighting, including four-flame lamps, new types of Pintsch mantle lamps and electric fixtures and storm-proof lanterns for buoy and beacon lighting.

Schoen Steel Wheel Co., Pittsburg, Pa.—Pressed and rolled steel wheels, showing the various stages of manufacture.

Schutte & Koerting Co., Philadelphia, Pa.—Injectors and injector regulating attachment; hand test pumps, syphons, automatic eductor and variety of valves.

Sellers, William, & Co., Philadelphia, Pa.—Non-lifting injector and attachments operating under steam; lifting injectors; check valves and locomotive feed-water strainer.

Shelby Steel Tube Co., Pittsburg, Pa.—Seamless steel tubing for locomotive flues and for link bushings; seamless steel locomotive bells.

Sherwin-Williams Co., Cleveland, Ohio.—Samples railroad paints, varnishes, shingle stains and paint pigments; photographs showing railroad buildings, cars and locomotives covered with Sherwin-Williams paints and varnishes.

Sprague Electric Co., New York.—Flexible steel armored hose for air brakes, car heating, signal line and pneumatic tool service.

Standard Metal Mfg. Co., Chicago.—S. T. B. car journal bearings; pig filling for old shell.

Standard Paint Co., New York.—Model of building covered with Ruberoid roofing. Ruberoid roofing for railroad cars and locomotive cabs; Giant insulating papers; P. & B. and S. P. C. insulation, and Ruberoid permanent colored roofing; flexible metal preservative paints and P. & B. insulating varnishes baking and air-drying.

Standard Steel Works, Philadelphia, Pa.—Forged and steel-tired wheels.

Stover Foundry & Mfg. Co., Myerstown, Pa.—Motor-driven pipe threading and cutting-off machine; automatic pipe bending machine.

Storrs Mica Co., Owego, N. Y.—Reception space.

Stowell Mfg. & Foundry Co., South Milwaukee, Wis.—Wilbern adjustable door hangers and Wilbern patent track for same.

Symington, The T. H., Co., Baltimore, Md.—Journal boxes for passenger, freight and electric equipment; Baltimore ball-bearing center plates and side bearings for railroad cars; testing and machining methods.

Tate, Jones & Co., Pittsburg, Pa.—"Kirkwood" combination fuel oil burners for furnaces, portable oil rivet furnaces and various appliances using fuel oil in railroad shops.

Trojan Car Coupler Co., New York.—The Junior coupler.

Underwood, H. B., & Co., Philadelphia, Pa.—Portable cylinder boring bar and portable 2-cylinder steam or air motor for driving same; portable rotary valve seat planing machine.

Union Spring & Manufacturing Co., Pittsburg, Pa.—Springs for locomotives and passenger, street and interurban cars; also springs for governors, frogs and switches and other uses.

U. S. Metal & Mfg. Co., New York.—The Columbia nut lock; Victor cast-steel car replacers; "Perfect" cast-steel car replacers; Cliff and Guilbert automatic hose reel; the Western malleable iron brake jaw; "Almeti" lumber stake; "Ideal" draw-bar centering device and the Hoyt flush car door; also a track exhibit of a car equipped with most of these specialties.

Wagenhorst, J. H., Co., Youngstown, Ohio.—Electric blue printing apparatus in operation.

Walworth Mfg. Co., Boston, Mass.—Stillson pipe wrench; Smith friction drills; "Neverstick" blow-off cock; Walworth pipe and millers' ratchet stocks and dies; general line of small tools for shop work.

Watson-Stillman Co., New York.—Hydraulic jacks, crank pin presses, wheel presses and rail benders.

Watters, J. H., Augusta, Ga.—Pneumatic track sander, working in glass case, showing action of the jet inside the sand box.

Wells Light Mfg. Co., New York.—Three sizes of the Wells light; Wells standard oil gas lamp; Wallwork's patent universal electric lamp brackets.

West Disinfecting Co., New York.—Disinfectants for all purposes and apparatus for applying the same.

Western Tool & Mfg. Co., Springfield, Ohio.—Full line of tool holders and Champion expanding mandrels; also portable stands, polishing wheels, Champion adjustable reamers and Lutz scrapers, scraper holders, file handles, etc.

Western Tube Co., Kewanee, Ill.—Kewanee union and high-duty metal valves; malleable cast iron and brass fittings; iron body valves and cocks.

Westinghouse Companies, Pittsburg, Pa.—New 8¼-in. cross-compound steam-driven air pump; Westinghouse friction draft gear; Westinghouse type "K-1" and "K-2" triple valves shown in section; also No. 5 distributing valve used in connection with new "ET" equipment; American Brake Co.'s automatic slack adjuster for passenger equipment; model of engine truck fitted with equalized brake and slack adjuster; also model of locomotive driver equalized brake gear; Westinghouse Automatic Air & Steam Coupler Co.'s automatic air and steam couplers applied to freight and passenger equipment (shown in model cars); Westinghouse Electric & Mfg. Co.'s enclosed type multiple d. c. arc lamps and the Cooper-Hewitt mercury vapor lamps; Nernst lamps for direct current; also various types of a. c. and d. c. fan motors; a ten h. p. variable speed d. c. motor fitted with Prony brake, its operation under various methods of control shown on graphic recording ammeter; Westinghouse Machine Co.'s 20-ton shop truck standard gage motor driven, and various types of storage batteries.

Westmoreland Coal Co., Philadelphia, Pa.—Reproduction of a room in coal mine, with electric mining machine in operation.

Wheel-Truing Brake Shoe Co., Detroit, Mich.—A brake shoe fitted with an abrasive for truing and dressing flat and worn wheels.

White Enamel Refrigerator Co., St. Paul, Minn.—"Bohn" syphon system of refrigeration.

Wilmarth & Morman Co., Grand Rapids, Mich.—New Yankee drill grinders; style "D" electrical grinders.

Yale & Towne Mfg. Co., New York.—Three types of chain blocks, including triplex, duplex and differential hoists. Also electric hoists and overhead trolleys. A large assortment of locks, including Yale locks, cabinet locks and padlocks. A full line of builders' and car hardware and Blount door checks; also burglar-proof time lock.

An Adding Machine Attachment.

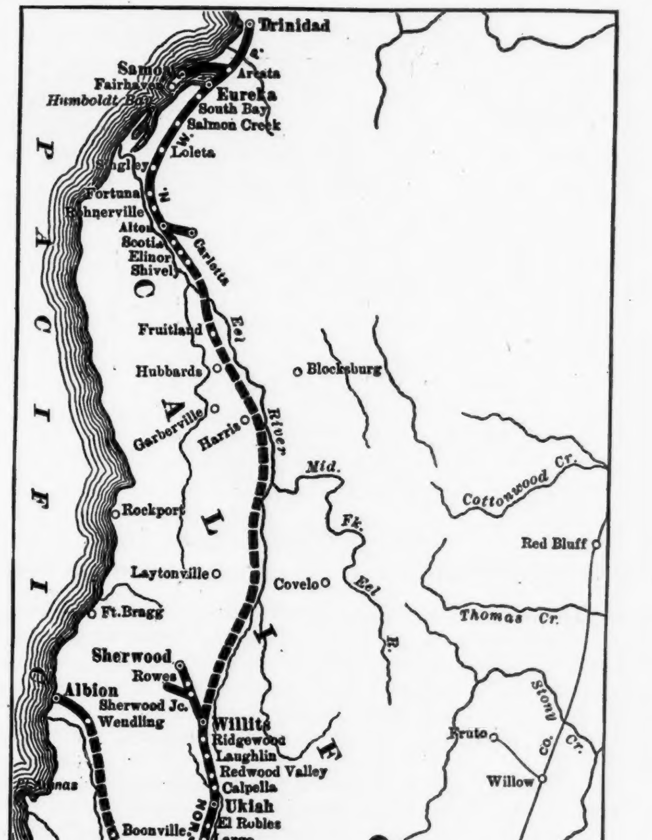
W. R. Gaither, Auditor of the South Chicago City Railway, Chicago, has invented an attachment for adding machines which it is claimed will increase considerably the range of usefulness of such machines. Heretofore, when an adding machine has been used in connection with pay-rolls, material accounts, car mileage, tonnage, sales and other statistics it was merely for ease and accuracy in totaling such figures after they had been posted by hand in the ordinary way. It necessitated about the same amount of delay in closing up such accounts as mental computation would have required. The inventor of the attachment referred to has shown that it is capable of an application to work of this nature which not only eliminates all mental addition, but also does away with the delay caused by the work of totaling as well.

As an illustration, take a pay-roll of 1,000 men, whether paid by the ton or hour or other basis; or a list of mileage to be credited to each of 1,000 cars. Instead of first posting this in records from day to day and leaving the totaling to be done at the end of the month or other period, the machine is arranged to receive a roll of paper, adapted to reel back and forth for daily entries, on which the time for each day is credited to the employee, and in addition thereto his accrued time is constantly brought up to date by use of the machine in making the registration. The result is a printed record of the time and also of the totals. At the end of the period the work of posting and totaling is complete just as soon as the last day's work is entered. The advantage of this to all concerned is obvious. It is especially helpful on tonnage and mileage statistics where the figures are large and tedious to post and add. It is expected that this invention will tend to relieve the stress which has been considered one of the necessary evils when closing monthly accounts in large offices.

This device can be seen in operation at the office of the Burroughs Adding Machine Co., Majestic Building, Chicago. The inventor's address is 6220 Lexington avenue, Chicago.

The Northwestern Pacific Railroad.

The Northwestern Pacific Railroad is a company which was organized in December, 1906, by the Southern Pacific and the Atchison, Topeka & Santa Fe to control in their joint interest certain railroads owned by them in northern California between the Southern Pacific's main line to Portland and the coast. In 1902 the Santa Fe bought the Eel River & Eureka Railroad and also a connecting road owned by the Pacific Lumber Company, in all 42 miles of line extending from Eureka into vast redwood forests. At the



Northwestern Pacific Railroad.

same time the California & Northern Railway, a nine-mile line from Eureka north to Arcata, was bought. These properties were taken over by the San Francisco & Northwestern, which was owned by the Atchison, Topeka & Santa Fe through the Santa Fe Land Improvement Company. These railroads were in a territory untouched by the Santa Fe lines and over 200 miles distant from them at the nearest point, Oakland. It was announced that the road would ultimately be extended southward to San Francisco bay or to a connection with some existing road over which the main line of the Santa Fe could be reached. The reasons for the purchase were given as follows in the annual report of the Santa Fe for 1903:

"Aside from the pine forests of Texas, Arkansas and Louisiana, the lumber supply of the United States now comes, and must continue to come, from the Pacific coast. Investigation of the subject led your directors to the conclusion that your lines should obtain access to the redwood forests of Northern California, embracing in the counties of Del Norte, Humboldt and Mendocino about 50,000,000,000 ft. The redwood lumber industry is now largely centered around Eureka, which city also possesses the only satisfactory harbor between San Francisco and Portland. . . . It is believed that these lines will not only be self-sustaining, but that they will contribute a large profitable tonnage to your existing lines."

In the territory immediately north of San Francisco bay near the coast were several roads owned by the Southern Pacific, the longest being the California Northwestern, which runs about 150 miles north from San Francisco bay. The Southern Pacific and the Santa Fe each deemed it to their advantage to consolidate these properties in one corporation through which extensions should be built so as to connect the separated lines of the two companies into a through line from San Francisco bay north to the lumber district about Eureka. This was done by the formation of the Northwestern Pacific Railroad, control of which is held by the Southern Pacific and the Santa Fe in alternate years. It will be observed that the roads originally owned by these two companies are not parallel lines.

The Northwestern Pacific is the successor of the Eureka & Klamath River (Oregon & Eureka), the San Francisco & North Pacific, the California North-western, the San Francisco & Northwestern, the Fort Bragg & Southeastern and the North Shore Railroads. The California North-western, the former Southern Pacific line, leases the San Francisco & North Pacific and has a main line from Tiburon, Cal., from which point ferry connection is made with San Francisco, north to Sherwood, 145 miles, and branches aggregating 57 miles. The Eureka & Klamath River operates 27 miles of road from Eureka to Camp 13, with 10 miles of logging spurs. Previous to the consolidation it was an independent property. The former Santa Fe line, the San Francisco & Northwestern, with a total of 50 miles of road, is to build an extension south about 100 miles to the California North-western at Willits, completing a through line of about 270 miles for the joint use of the Southern Pacific and the Atchison, Topeka & Santa Fe from San Francisco north to Eureka. The North Shore operates about 80 miles of road from Sausalito north to Cazadero, paralleling the California Northwestern on the west. The Fort Bragg & Southeastern is a short road now in operation from Albion, which is on the coast southeast to Wendling. An extension of this line is projected southeast to Healdsburg on the California North-western.

President Mellen on the Boston & Maine Purchase.

The following correspondence between Governor Guild, of Massachusetts, and President Mellen, of the New York, New Haven & Hartford, in regard to the acquisition for the New Haven of the Boston & Maine, is notable for the action taken by the state executive and for the full discussion of the effects of the merger by the railroad president.

On June 4, Governor Guild wrote to President Mellen as follows:

"Undisputed but unofficial statements in regard to a proposed combination between the New York, New Haven & Hartford Railroad system and the Boston & Maine Railroad have become so general that it seems to me highly desirable in the public interest that any official statements concerning the methods that have been or are to be pursued in effecting such consolidation should be made to the responsible representatives of the commonwealth.

"I feel sure that you will have no objection to sending me such information at your earliest convenience, together with any statement you may care to make in regard to the future development of transportation, commerce and industry in Massachusetts."

Under the same date President Mellen replied as follows:

"Dear Sir: In answer to your favor of even date, let me say: Interests identified with my company have acquired a large stock interest in the Boston & Maine Railroad and have entered into an agreement to acquire such additional stock as may desire to avail of the terms within a reasonable time in the future. The basis of such acquisition made and proposed has been the exchange of shares of the two companies share for share, with a commission to be paid by Boston & Maine shareholders of 75 cents per share, a similar commission being paid by the purchasers.

"While no shares of Boston & Maine stock are held by my company and it has not been proposed any shall be, still it is unquestionably true the purchases are made and held for its account in the hope and belief that an ultimate union of the two properties will be permitted, and when the results of a common control are made manifest it is believed the benefits will so appeal to the interests of the commonwealth as to warrant a consolidation of the two properties into one, under such restrictions and regula-

tions, of course, as may seem necessary and desirable to safeguard all interests.

"Until the authority of the commonwealth is obtained, no change can be made in the status of the Boston & Maine Railroad; none is proposed—nor is there desire that any shall be. The company will be handled by its board of directors, who will elect its own officers, who will administer the property in its own interest, performing its duties and fulfilling all its obligations to the public and its stockholders in the future as in the past.

"The purchase of the shares of Boston & Maine stock referred to was made not as a result of the desire for aggrandizement on the part of the interests dominant in our company, but that they should not have been sold elsewhere, as would have otherwise been the result, and which might have been most detrimental, we believe, not only to the interests of our company but, as we conceive, of those of the commonwealth as well.

"No stock has been or will be issued in connection with this purchase against which a charge of stock watering or inflation can lie, for every share of New Haven stock issued will represent a share of Boston & Maine retired, and no capital will be outstanding on which dividends must be paid more than at the present time.

"No reduction of facilities is permissible in the view of an intelligent management of a public corporation—one that has favors to ask of the commonwealth to successfully carry out its plans—but rather that increased facilities shall be given that an increased business may result and a better net return be available; for increased development has invariably followed an increase of facilities and reduction in rates, in our experience, in a highly developed and congested territory like that served by the Boston & Maine lines.

"It is our confident belief an increased service without transfer through the Connecticut Valley through the union of these properties under a common control and ultimately by consolidation, will result in the development of a largely increased revenue through the greater convenience available. Similarly a through service by way of Worcester and Nashua through the Merrimac valley cannot fail to benefit materially the public, with resulting advantage to the revenue of the railroad. A through service to and from the state of Maine offers possibilities for revenue not to be lightly considered—possibilities so large, with such a field for exploitation so near at hand, it seems little doubt should be expressed of the result.

"It is possible through this common control to bring the roads in Boston all into a union station with resulting convenience to the traveling public and economy to the railroads. It is also possible with the great amount of contributive business under a common control to compel such consideration of Boston's position that the differentials under which its merchants have so long suffered shall no longer discriminate against its importance in the commercial world.

"Having no possibility of becoming a trunk line to and from New York and the West, the whole influence of our company must be exerted upon the attraction of the largest amount of business to and from Boston as against any other port, and the economy in concentration of the terminals must of necessity interest the company in the development of the property of the commonwealth in South Boston for this purpose, thus making possible for the first time a realization of the plans of those who projected that improvement.

"Nothing our company could do could place it under greater bonds to do all that was in its power to develop to the utmost anything and everything that will tend to promote the business of Boston and New England. If they cease to grow and prosper we shall wither and die—we cannot prosper in a community alone—we must share your burdens as well as your prosperity. It is unworthy of discussion—the fear of misuse of power if this combination be permitted. Why should this old commonwealth fear any artificial creation of its own or of a neighboring state transacting business within its borders by its permission? What matters it who owns the shares of your corporations? The corporations still exist and are subject to your laws and your control. They cannot move away or avoid service or evade their obligations if your officials do their duty. The power to control, to regulate is unquestionable—the creature cannot become greater than or independent of its creator. The company I represent recognizes fully its obligations to the public, desires to be a law abiding citizen of your commonwealth, is trying to perform all its duties efficiently and to your satisfaction, and believes it is in position to do more for the commercial interests of your commonwealth at the present time than was ever possible before, and seeks to do it in such a way as to merit your approbation and be recognized as your most efficient public servant."

The production of coal in the German Empire for the first quarter of this year was 65,164,000 tons, which is 1¾ per cent. more than last year; meanwhile the exports were 6½ per cent. less and the imports 13½ per cent. more than last year; so that the home consumption of coal increased 3½ per cent., indicating that the industrial activity, never equalled theretofore, is fully maintained.

Recent Developments in Air Brake Control Apparatus.

BY F. H. PARKE AND S. W. DUDLEY.

(*Concluded from page* 808.)

The features considered in the previous article, which were so successfully incorporated in valves intended particularly for traction service, afforded at the same time a means for securing certain results which had long been desired, but heretofore never obtained in stead road operation. It is evident that the quick action valves

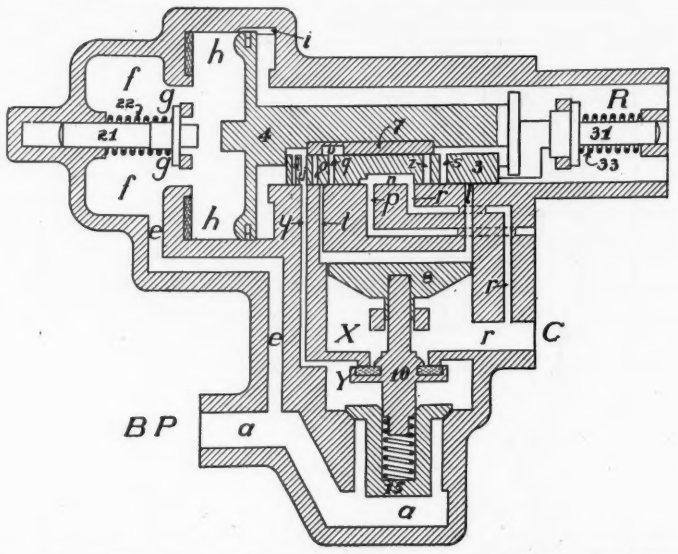


Fig. 10—Type K Freight Triple Valve; Full Release Position.

which have been referred to can be applied with equal success to steam road equipments. In handling freight trains particularly, the quick service feature is of especial advantage. It enables the brakes to be applied by a service reduction from the head to the rear end of a train of any length at a more rapid rate than the slack could run in, thus preventing the disastrous results often arising from that source.

For a similar reason, it had long been desired to effect as nearly as possible a simultaneous release of all the brakes in the train, so as to prevent the running out of the slack from the head end which, when releasing the brakes on a train of any considerable length at slow speeds, is often the cause of such severe strains on the draft gear as to part the train. To explain how this may happen, suppose the brakes to have been applied and the speed of the train reduced to five miles per hour. If a release is then made, without coming to a full stop, the brakes on the forward cars release first, allowing these to pull away from those farther back, on which the brakes still remain applied.

As is well known, it is impossible to force the air back through the brake pipe, when making a release, either in amount or at a pressure sufficient to effect the release at the rear of a long train until some time after the brakes at the head end are fully released. This is due not only to the friction in the pipe, but also to the fact that the air necessary to accomplish the desired result is being to some extent absorbed by the recharging of the auxiliary reservoirs all along the line. Consequently, the pressure at the head end of the train which is more than ample to release and fully recharge, falls rapidly as the distance from the front end increases, until,

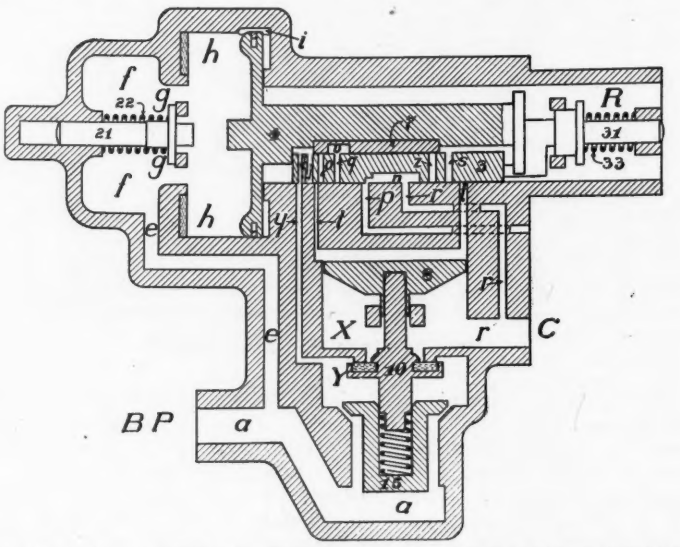


Fig. 11—Type K Freight Triple Valve; Retarded Release Position.

after about the fortieth car, it is almost impossible to raise the brake-pipe pressure fast enough to secure the desired rapidity of release and recharge.

This condition, however, was made use of in an ingenious manner to practically reverse these effects, which before had been unavoidable. Under ordinary conditions of service, an increase of a pound or two pressure on the face of the triple-valve piston is required to move it. A much greater difference than this is obtained at the head end of the train, and this difference rapidly decreases as the distance from the source of supply to the brake

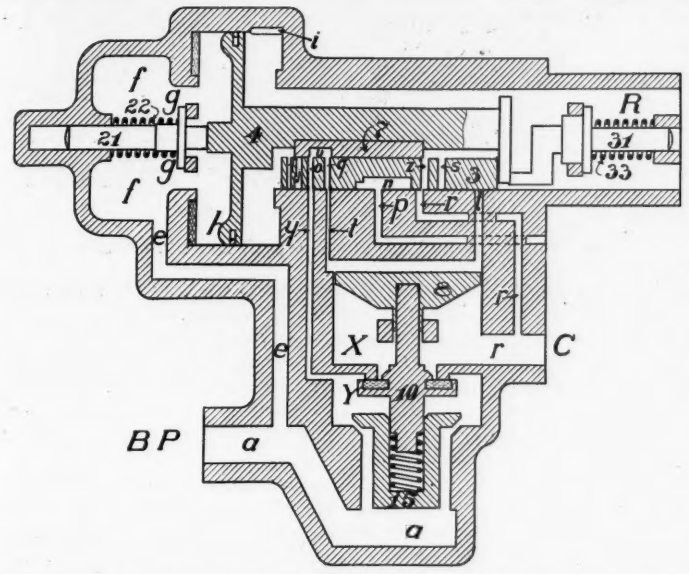


Fig. 12—Type K Freight Triple Valve; Quick-Service Position.

pipe is increased. If this greater difference of pressure which is unavoidable at the head end of the train can be utilized to cause the operating parts of the triple valve to move so as to restrict both the release of the brake-cylinder pressure and the recharging of the auxiliary reservoir, evidently the release of the brakes on the forward part of the train will be delayed, and the air forced to flow more promptly and at a higher pressure toward the rear and effect a more uniform release and recharge. In this way the brakes on the train as a whole can be released almost simultaneously.

FREIGHT TRIPLE VALVES.

Fig. 10 shows the new freight triple valve, a simple modification of the standard type, which carries this principle into effect. The modification consists chiefly in the addition of what is called the retarding-device spring and stem, shown under the letter R. When the brake-pipe pressure is raised gradually, creating only a slight increase in pressure on the brake-pipe side of the piston, its movement toward release position is arrested by striking the retarding device stem as shown in the cut. In this position the cylinder port *r* has a full opening through the exhaust cavity *n* in the slide valve to the exhaust port *p*, allowing a free flow of air from the brake cylinder to the atmosphere. At the same time the quick service port *y* is in full register with port *j* in the slide valve, which together with the feed groove *i*, produces the quick recharging of the auxiliary reservoir.

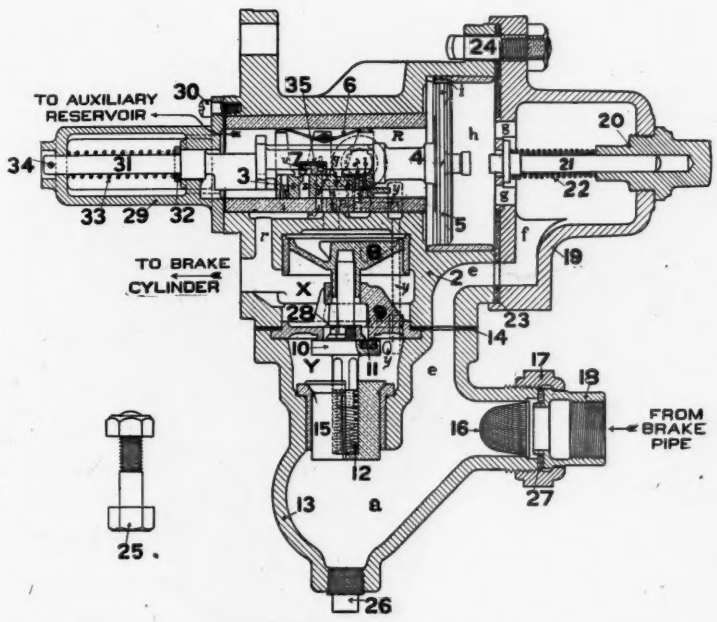


Fig. 13—Section Through Type K Freight Triple Valve.

On the other hand, when the rise in brake-pipe pressure is sufficiently rapid to cause enough difference in pressure to compress the retarding device spring, the piston and slide valves are moved beyond the full release position to that shown in Fig. 11, known as the retarded-release position. In this position a small narrow extension of the exhaust cavity *n* connects the cylinder port *r* to the exhaust port *p*, which restricts the flow of air from the brake cylinder to the atmosphere; at the same time the flow of air to the auxiliary reservoir is entirely stopped, so far as the feed groove *i* is concerned, by the piston sealing against the end of the bush, while the feed up through the quick service port *y* now passes through a much smaller port, *l*, in the slide valve. Thus the rate of recharge is greatly retarded. The piston remains in this position so long as the excess pressure on the brake-pipe side remains sufficient to hold the retarding device spring compressed. As this difference becomes less, the spring forces the piston and slide valve together back to the full release position shown in Fig. 10.

This triple valve, known as the type K, also includes the quick service feature previously described, as will be seen by reference to Fig. 12, which shows the valve in quick-service position.

This feature is of special importance in handling long freight trains, because heretofore it has been difficult to cause all the brakes to apply on a train of over 75 cars, even if a full service reduction is made, with the triple valves all in fairly good condition, for the reason that the standard type of triple valve was not designed to operate under such extreme conditions. The new type K triple valve, however, including as it does the features of quick service, retarded release, restricted recharge of the reservoirs on the head end and quick recharge of those on the rear end, affords complete control of a train of any length. The cuts of this valve, Figs. 10, 11 and 12, previously referred to, are diagrammatic. Fig. 13 shows the valve in true section, while Fig. 14 is a photograph of

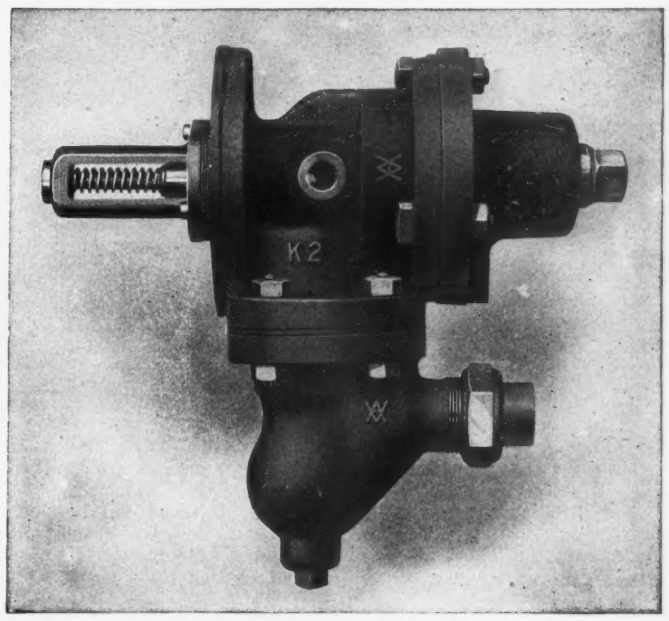


Fig. 14—Type K Freight Triple Valve.

the device. Although this valve has a new designation, and includes all the new operative features just mentioned, it is not greatly different from the old standard freight triple valve in construction or appearance. In fact, the standard F 36 or H 49 (now the H-1 and H-2) triple valves now generally in use in freight service, may be changed into the type K triple by simply adding the retarded release device, substituting a new bushing, slide valve and graduating valve for the old, and drilling the quick service port in the body and check valve case. It will be noticed from the photograph that the retarded release device projects into the auxiliary reservoir when the valve is in position. For the purpose of distinguishing this type of valve readily from the standard types, a rib is cast on the top of the body, extending about half way from flange to flange, which can be easily seen from the side of the car.

GRADUATED RELEASE.

In the application of the graduated release triple valves, to electric traction service, the reserve supply of air used to obtain the graduated release feature, was obtained in the following manner: It was necessary for the main reservoirs of all motor cars to be connected through the train in order to equalize the amount of work required from each compressor. This was effected by adding a second pipe line, the pressure in which is always maintained at that for which the feed valve supplying the system is set. This pipe, called the "control pipe," furnished a convenient source for the "reserve supply" needed, as it was then necessary only to make suitable connection between it and the triple valve. In the

case of steam road practice, however, this second pipe line did not exist, and it was impracticable to add it solely for this purpose. For this service, therefore, an additional or "supplementary" reservoir was located on each car and connected to the triple valve in place of the control pipe. When the triple valve is in release position, this reservoir is being charged from the brake pipe along with the auxiliary reservoir, and to the same pressure. When this reservoir is charged and an application of the brakes made, the action is precisely the same as when a "control" pipe is used, with this exception: With the control line, the volume of air available at feed-valve pressure is practically unlimited, while with supplementary reservoirs, the reserve supply pressure is limited by the supplementary reservoir capacity. The operation of the two systems is, however, substantially the same, since the supplementary reservoir volume is ample to permit of as many graduations in the release as it is feasible to employ during the stop.

THE HIGH SPEED VALVE.

Along with the development of the systems which have been described, the conviction had been steadily gaining ground that when a quick stop is made from high speeds a much greater braking power, and therefore higher brake cylinder pressure, can be advantageously used than has previously been employed. Obviously with a system using a reserved supply, this could be attained by locating a valve so that when an emergency application of the brakes was made, the supplementary and auxiliary reservoir volumes would unite and flow to the brake cylinder. The brake cylinder pressure thus obtained would be that at which the brake cylinder, supplementary, and auxiliary reservoir volumes equalized, the increase in pressure thereby secured being obviously considerable. This idea was first applied in practice in exactly the manner above mentioned, by means of a so-called "by-pass valve" located in the piping system. The results secured were so satisfactory that steps were immediately taken to develop this device as a

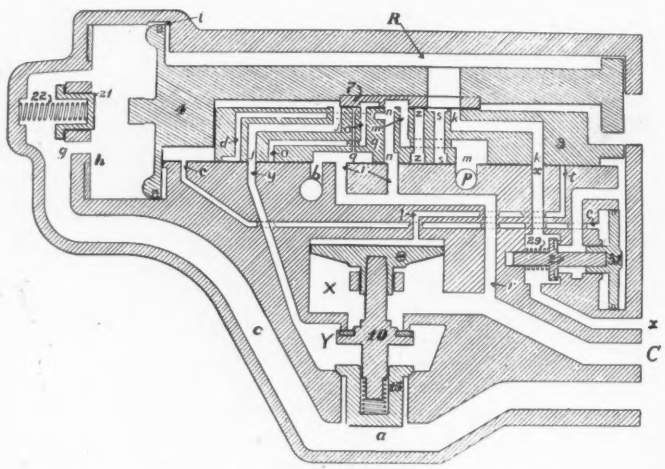


Fig. 15—Type L Triple Valve; Release Position.

permanent part of the graduated release equipments. In order to simplify the apparatus, the by-pass valve was incorporated into the triple valve itself, thus leading to the development of what is now known as the type L triple valve.

The diagrammatic view of this valve is shown in Fig. 15. The triple valve includes all of the features of the graduated release triple valves, with the addition of the by-pass valve as shown. Auxiliary reservoir pressure is always on one side of the by-pass piston, and in all positions of the triple-valve slide valve, except emergency position, it also acts on the other side through port *c*. The device is therefore entirely inoperative under these conditions. But when the triple-valve slide valve goes to the emergency position, as shown in Fig. 16, the air on the left of the by-pass piston is allowed to flow to the brake cylinder through ports *c*, *d*, *q* and *r*, thus creating an excess pressure on the right side of the by-pass piston, forcing it to the left, and allowing the supplementary reservoir pressure to flow from port *x* past the by-pass valve to the auxiliary reservoir. Thus in emergency applications, a volume of compressed air much larger than that contained in the auxiliary reservoir is allowed to flow to the brake cylinder, which increases the pressure of equalization to a very considerable degree. The reasons for adopting the methods described above, whereby a considerably increased brake cylinder pressure is available in case of emergency above that which can be obtained in ordinary service reduction, are as follows:

As already pointed out, it is necessary that not too high brake-cylinder pressures be obtained, when moderate brake pipe reductions are made, in order that ordinary service stops, from moderate or low speeds, may be made with smoothness, accuracy and in such a manner that the engineer can judge accurately his control over the train. On the other hand, when an emergency arises the consideration of safety is paramount. It then becomes necessary to stop in the shortest possible time, regardless of anything else. To

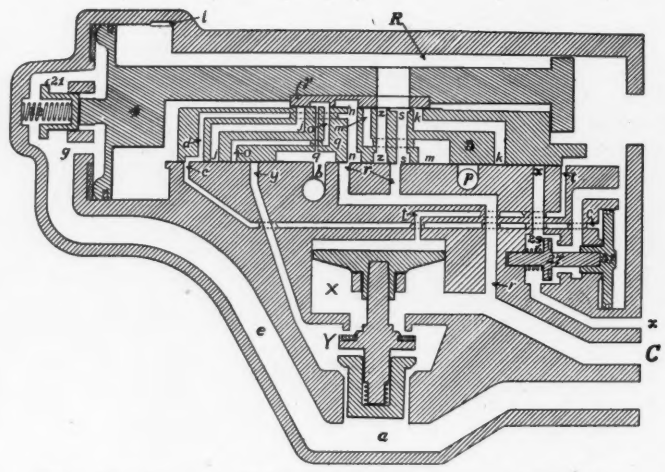


Fig. 16—Type L Triple Valve; Emergency Position.

do this requires the highest possible brake-cylinder pressure which can be used without actually sliding the wheels.

THE HIGH SPEED SAFETY VALVE.

In the high-speed brake, the high-speed-brake reducing valve serves to prevent the accumulation of excessive brake-cylinder pressures in service operation. In emergency applications not only is a higher pressure obtained, but the time during which this pressure is held is considerably lengthened.

The development of this idea is carried one step further in the type L triple valves. The service operation, so far as the amount of brake-cylinder pressure obtained is concerned, is no different than before. The high-speed reducing valve is replaced by a safety valve which forms a part of the triple valve and is connected directly to the brake cylinder pressure when the piston is in service position, as shown in Fig. 17. Port *b* leads directly to the safety valve, and in the position shown is connected through cavity *q* to the brake cylinder port *r*. This serves the necessary purpose of limiting the brake cylinder pressure obtainable in service reductions to the adjustment of the safety valve.

But in emergency applications it has been demonstrated by tests and actual service on the road that, when running at high speeds, the high cylinder pressure obtained with the L triple valve in an emergency application can safely be held without any reduction, to the end of the stop, and this without increasing the danger of objectionable wheel sliding. The L triple valve was accordingly designed so that when the piston moves to emergency position the connection between the brake cylinder and safety valve, as described above, is cut off, this position of the ports being shown in Fig. 16. In this manner the equipment comprehends, within the triple valve itself, the functions of the present high-speed brake, with the addition of the quick service, graduated release, quick recharge and augmented emergency brake cylinder pressure features.

HIGH SPEED TRACTION SERVICE VALVE.

This latter feature of augmented emergency brake-cylinder pressure is equally valuable in connection with high speed traction service, where it may not be advisable to use a triple valve with quick action features, as in case of the cars operating singly, as well as in trains. The next step taken was therefore to incorporate this feature in the type T triple valve already described, the new valve being called the type M triple valve. A photograph of this valve is shown in Fig. 18. A detailed description of it is unnecessary inasmuch as it corresponds throughout with the type T triple valve except for the addition of the by-pass valve just explained in connection with the type L triple valve. In the type T triple valve, no higher brake-cylinder pressure could be obtained in emer-

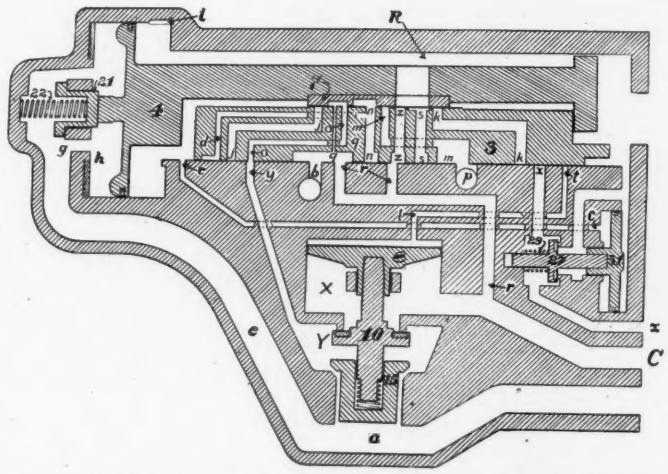


Fig. 17—Type L Triple Valve; Quick-Service Position.

Fig. 18—Type M Triple Valve.

gency than in service operation; whereas with the type M triple valve, while the cylinder pressures obtained in service reductions are kept down to the required limits for flexibility at moderate speeds, a considerable increase in brake-cylinder pressure can be obtained when any occasion arises for making a quick stop from high speeds.

STRAIGHT-AIR, WITH AUTOMATIC EMERGENCY FEATURE.

One of the novel and ingenious developments in connection

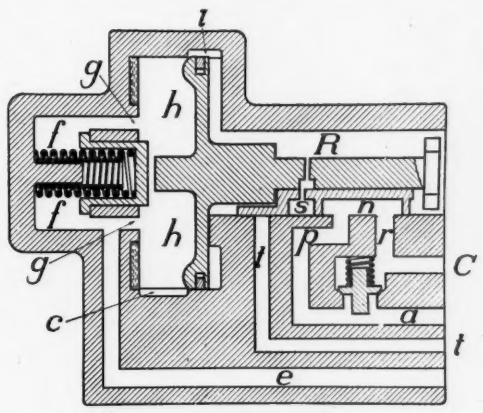


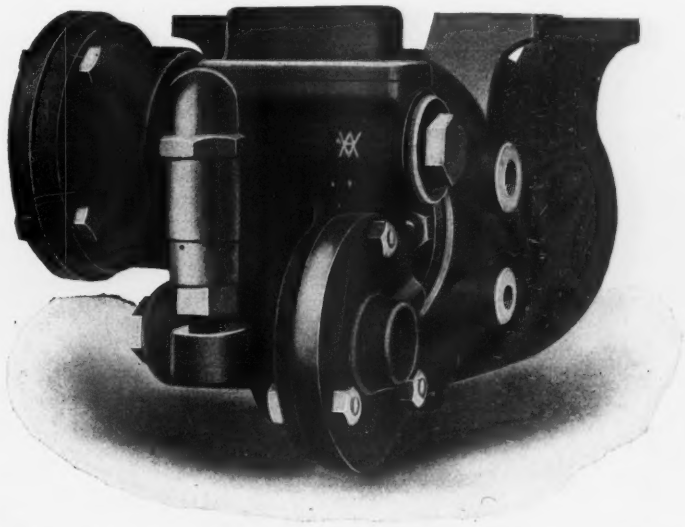
Fig. 19—Emergency Valve.

with the application of air brakes to traction service is what is known as the straight-air brake equipment with automatic emergency feature. During the time that electric traction service was confined entirely to single car operation, the straight air brake equipment met all reasonable demands and was largely adopted. But it soon became desirable to operate two cars together for either a portion of the time or continually. As has been already pointed out, good practice demands that in such cases, some safety feature

Type L Triple Valve.

be incorporated in the brake system, whereby, in case of a break-in-two or rupture in the piping, the brakes on both vehicles will be automatically applied. As the straight air system had already been made standard for such service and it was often not desirable to change over to a new system of operation, viz., the automatic, in order to secure the necessary safety feature, some method was required whereby the straight air system could be made to operate automatically in case of emergency. This was accomplished by the addition of a device called the emergency valve, shown in Fig. 19, and an additional pipe line. This latter is normally under pressure and connected to the emergency valve at *e*. Chamber R is connected to the main reservoir which is supplied with air by the compressor. In ordinary service operation, the air brake operates as a straight-air system, the air flowing directly to and from the brake cylinder from the brake valve through the usual straight-air pipe. But when an emergency application of the brakes is made by the motorman, or where a break in two or other accident causes any rupture of the piping system, a sudden reduction of pressure results in the pressure pipe, causing a reduction in port *e*, which communicates to the chamber *h*, behind the valve piston. The air being unable to flow fast enough from the reservoir side R of the piston through the feed grooves *i* and *c* to keep up the pressure, a differential pressure sufficient to move the piston and its attached slide valve is caused. This opens the port *r* leading from the main reservoir to the brake cylinder, and applies the brake automatically. The brakes would then be released through the brake valve in the ordinary manner.

This equipment, therefore, furnishes a system of straight-air



Distributing Valve; Chief Controlling Mechanism of the " E T" Locomotive Equipment.

control which gives perfect satisfaction in single or two car operation, for the particular kind of service outlined above, with the automatic application of the brakes always in reserve as a safety feature in case of necessity.

LOCOMOTIVE BRAKE EQUIPMENT.

The treatment of this subject of developments in air brake control apparatus would hardly be complete without mentioning the so-called "ET" locomotive brake equipment. This equipment has been so thoroughly described in the technical press and before various societies, that a detailed description of it here does not seem necessary. It need only be said that by it the installing and handling of locomotive brakes has been so simplified and improved that it is being quite generally adopted as standard equipment. Before its introduction, the value of the locomotive brake in developing a retarding effect on the train, as a whole, was very uncertain. The almost constant use of the locomotive, as well as the difficulty of getting at the apparatus, made its proper maintenance very difficult. As a result, excessive leakage and uneven adjustment often led to such losses in braking power as to render the stopping power of this most important unit in the train, of little value. With the ET equipment, however, not only is the engineer provided with a means of operating the locomotive brakes either in conjunction with or independently of the train brakes, as occasion arises, but the application resulting is always the same for any certain manipulation by the operator, and the cylinder pressure obtained is uniform in all cylinders on the locomotive and maintained during the application to the pressure first obtained, against such leakage as may exist. Many other features both of safety and convenience are incorporated in the details of this equipment in such a way that it has the good points of all previous equipments and eliminates their objectionable features.

The foregoing gives only the most important changes that have taken place in the art of train braking during the past two or

three years. It cannot by any means be said to cover the whole field of progress in this line, but will perhaps serve as an indication of its growth and development. It will, to some, bring home the fact that progress in one line of the mechanic arts compels a like growth in all other lines. The vast development of the resources and industrial establishments of this country have made a similar development of railroad rolling stock indispensable, which in turn has compelled such changes in all rolling stock auxiliaries as will enable them to keep pace with the requirements of the day. These changes are still going on as new conditions arise, so that this article is only a chapter of their history.

Electric Train Lighting.

A paper on electric train lighting containing considerable interesting data was presented at the April meeting of the Western Railway Club by O. W. Ott, of the mechanical department of the Burlington. The introductory portion of the paper describes the three principal systems—the storage battery, axle-light and head-end systems. Our readers are familiar with the general features of these. Following this is a comparison of first cost and cost of operation of the three systems. For this purpose an eight-car train is assumed as a basis, doubling back and forth over a 500-mile run over night and lying up in passenger yards during the day. A 14-hour schedule is assumed, with a pair of trains, one leaving each terminal at 6 p.m. and arriving at the other terminal at 8 o'clock the next morning; each train including a mail car, express car, combination baggage and smoker, chair car, coach, dining car, standard sleeper and observation state-room sleeper; the diners serving supper and breakfast running back and forth over a distance of 80 miles at each end of the run on a schedule time of two hours for the 80 miles.

For a well lighted train the standard lamp equipment for the various cars is about as follows: Sixty ft. baggage and express cars, 12-16 c.p. lamps; 60 ft. mail cars, 24-16 c.p. lamps; 70 ft. combination baggage and smoking cars, 4-8 c.p. lamps and 20-16 c.p. lamps; 70 ft. chair cars, 31-8 c.p. and 22-16 c.p. lamps; 70 ft. coaches, 40 8 c.p. lamps and 22-16 c.p. lamps; dining cars an average of 30-8 c.p. and 40-16 c.p. lamps; and sleepers an average of 40-8 c.p. and 32-16 c.p. lamps each. Using these figures for lamp equipment the sample train would contain 185-8 c.p. and 204-16 c.p. lamps, with a grand total of 389 lamps. Using a figure of ½ amp. at 110 volts for the current consumption of a 16 c.p. lamp, the total load would be 148-25 amp. at 110 volts, or 16.3 k.w.

From tests made on a train very similar to the sample train by Mr. Edward Wray, of the University of Wisconsin, the actual running load on our sample train would average as follows: Leaving the yards at 5.30 p.m. and until cutting out the dining car at 8 p.m., the load will average 16 k.w. From 8 p.m. until about 11 p.m., the load will average 14 k.w. From 11 p.m. until 8 a.m. the load will average about 7 k.w., as about 11 p.m. all the light except those on the night circuits are cut out. By multiplying the rates by the time in effect the round trip current consumption will be found to be 290 k.w. hours, this figure to be taken as the actual consumption of current at the lamps. As our pair of trains will make 365 round trips a year, this gives a yearly consumption of 105,850 k.w. hours.

The first cost of equipment for the pair of sample trains will be as follows:

Head-End System.

2 Curtis turbo-generators, 25 k.w. at $1,400	$2,800.00
Switchboards, instruments, steam fittings and piping, wiring and installing dynamos, complete, 2 cars at $400	800.00
4 sets of storage batteries (each 54 cells, 240 amp. hr. capacity, 216 cells at $20.50	4,428.00
Overhead train line (3-4/0 wire with Gibbs connectors), 16 cars at $130	2,080.00
Battery boxes and crates, 4 cars at $100	400.00
Wiring and fixtures, exclusive of train line, 2 chair cars, 2 coaches, 2 dining cars and 4 sleepers—10 cars at $300 av'g	3,000.00
Wiring and fixtures, exclusive of train line, 2 combination cars at $180	360.00
Wiring and fixtures, exclusive of train line, 2 mail cars, and 2 express cars, 4 cars at $30 average	120.00
Total for 16 cars	$13,988.00
Average per car	874.25

Storage Battery System.

Battery—16 sets—32-240 amp. hr. cells each set, 512 cells at $20.50	$10,496.00
Battery boxes and crates, 16 cars at $70	1,120.00
Overhead train line (3-4/0 wire with Gibbs connectors), 16 cars at $130	2,080.00
Wiring and fixtures, exclusive of train line, same as above 16 cars	3,480.00
Total for 16 cars	$17,176.00
Average per car	1,073.50

Axle Dynamo System.

Generators, regulators and suspensions, 16 cars at $670	$10,720.00
Battery, 32 cells, 240 amp. hr. per car, 512 cells at $20.50	10,496.00
Battery boxes and crates, 16 cars at $70	1,120.00
Wiring and fixtures, exclusive of train line, same as above, 16 cars	3,480.00
Application of axle dynamos to car, 16 cars at $60	960.00
Total for 16 cars	$26,776.00
Average per car	1,673.50

The figures given for wiring and fixtures on all the cars except mail and express will cover the cost of changing the Pintsch or acetylene into combination electric fixtures, the addition of bracket side fixtures and the laying of all wire in conduit. Where plain socket fixtures are placed along the under side of the lower deck crown mould with the wires run in the moulding and the oil or gas lamps left undisturbed, the cost exclusive of the train line would not be over $50 per car.

It will be noted that the train line has not been included in the axle dynamo system estimate, although to facilitate handling axle-lighted cars in head-end trains, it would be advantageous to have train lines applied. With the storage battery system the train line is absolutely essential for charging purposes. It will also be noted that 32 cells of 240 amp. hr. batteries have been specified for the axle dynamo cars. A smaller battery capacity than this has not been found satisfactory and in several instances 32 cells of larger capacity have been applied.

COST OF OPERATION.

Current Cost—Head-End System.—With the head-end system with a 4/0 wire train line it requires 114 volts at the generator to give 110 volts at the lamps on an eight-car train. This gives 96.4 per cent. efficiency of transmission. The storage batteries will be required to carry the lighting load for average periods of 12 minutes each at four engine changes and four dining car cuts in the train per round trip. Noting that two engine changes are made during periods of heavy load and two at the periods of the light load and that when the dining car cuts are made only the two rear cars—the sleepers—are lighted from the batteries, it will be found that the total battery discharge will be about 10 k.w. hrs. per round trip.

Assuming a watt efficiency for the batteries of 50 per cent., then to make up the current loss involved in using the batteries the total kilowatt hour consumption will be increased from 290 to 300 k.w. hrs. per round trip. Taking the efficiency of transmission into account to give 300 k.w. hours at the lamps the generator output will have to be 311.2 k.w. hrs. This means that for a lamp consumption of 105,850 k.w. hrs. per year the generators will be required to put up 113,588 k.w. hrs.

The tests conducted by Mr. Wray on a 25-k.w. turbo-generator set showed an average steam consumption of about 90 lbs. of steam per k.w. hr. with the load averaging around 15 k.w. and about 140 lbs. per k.w. hr. for a load of 7 k.w.; these figures both for a kilowatt hour delivered at the switch-board. Dividing the current consumption up we find that 55 per cent. will be generated at the 15 k.w. rate and 45 per cent. at the 7 k.w. rate. This gives a total steam consumption per year for the pair of trains of 12,778,650 lbs.

Tests on passenger runs similar to that of the sample train have shown an average evaporation of 5.5 lbs. of water per pound of coal actual, with coal at $2 per ton delivered at the locomotive. The total coal consumption per year would therefore be 2,323,390 lbs., or 1,161.69 tons, at a cost of $2,323.38.

CURRENT COST, STRAIGHT STORAGE SYSTEM.

For the straight storage system the current cost can perhaps be most accurately derived by assuming a value of 2½c. per k.w. hr., delivered at the passenger yards. This figure would perhaps be a trifle low for small isolated power plants. From the tests conducted by Mr. Wray on a storage battery lighted train which was equipped with batteries which were somewhat old and worn out, the average watt efficiency was found to be 49.2 per cent. In these tests readings were taken of input and output on four cars for a period of six days.

It would probably be more fair to assume a watt efficiency of 65 per cent. as representing average conditions, under which straight storage systems operate. With 65 per cent. efficiency 105,850 k.w. hrs. at the lamps would require 162,846 k.w. hrs. at the passenger yard terminals at a total cost of $4,071.15 per year.

CURRENT COST, AXLE DYNAMO SYSTEM.

For the axle dynamo system the current cost can be figured as follows: In the Wray tests previously referred to, covering five different cars having axle dynamos, the average total efficiency was 42.6 per cent. This efficiency was derived as follows: The lamp consumption divided by the total generator output was multiplied successively by the generator efficiency and the belt drive efficiency. The belt drive efficiency was assumed at 97 per cent., or 3 per cent. slip. It would probably be safe to assume 50 per cent. total efficiency as representing average conditions. Changing the total yearly consumption of 105,850 k.w. hrs. into horse-power we have 141,890 h.p. hrs. at the lamps. This figure divided by 50 per cent. efficiency gives a total of 283,780 h.p. hrs. taken from the wheels.

Let us figure only the extra coal required at the locomotive due to the increased train resistance, making allowance for power taken from the axles when the locomotive is drifting and not working steam. Tests on passenger locomotives on a very level division showed a ratio of 94 per cent. between total time using steam and total time in motion, while on a very hilly division this ratio was 76 per cent. As these two divisions will fairly represent the extreme conditions found on the average road, it would be safe to

place the figure for the sample train at 85 per cent., the average of the two.

A part of the time in motion while not using steam is due to the making of stops and hence a portion of the time the running speed will be below the critical speed of the axle dynamos. This critical speed is generally about 20 m.p.h. A figure of 90 per cent. would probably fairly represent the portion of the total power taken from the car axles while the locomotive is using steam. Therefore 90 per cent. of 283,780 h.p. hrs., or 255,402 h.p. hrs., will have to be accounted for by extra coal consumed at the locomotive. An average passenger locomotive will deliver a horse-power hour at the drawbar for 8 lbs. of coal at $2 per ton. This makes a total coal consumption of 2,043,216 lbs., or 1,021.6 tons, at a cost of $2,043.20 per year for the pair of trains.

Cost from Increased Weight of Train.

Head-End System, Weights:	Lbs.
2 turbo-generators, 25 k.w., at 3,600 lbs.	7,200
2 switchboards, piping, fittings, etc., at 600 lbs. per car.	1,200
216 cells of battery at 100 lbs.	21.600
4 cars battery boxes at 800 lbs. per car.	3,200
Total for 16 cars.	33,200
Average per car.	2,075
Storage Battery System, Weights:	Lbs.
Battery, 16 cars, 32 cells, each at 100 lbs.	51,200
Battery boxes and crates, 16 cars at 600 lbs.	9,600
Total for 16 cars	60,800
Average per car	3,800
Axle Dynamo System, Weights:	Lbs.
Generators, suspensions and regulators, 16 cars at 1,100 lbs.	17,600
Battery 16 cars, 32 cells, each at 100 lbs.	51,200
Battery boxes and crates, 16 cars at 600 lbs.	9,600
Total for 16 cars.	78,400
Average per car	4,900

Consider only the cost in coal at the locomotive for carrying this extra weight. From tests made on passenger trains which run on a schedule very close to that of our sample trains, about 20 lbs. of coal was consumed per 100 ton-miles, with coal at $2 per ton. As our assumed mileage was 500 miles between terminals we will have a total yearly mileage of 182,500 miles for each car. Then for the head-end system we would have 16.6 tons x 182,500 miles, or 3,029,500 ton-miles, with a coal consumption of 605,900 lbs., or 302.95 tons at a cost of $605.90 per year. For the storage battery system, remembering that the dining cars only run a distance of 80 miles at each end of the run, we would have 26.6 tons x 182,500 miles and 3.8 tons x 58,400 miles, or a total of 5,076,420 ton-miles, with a coal consumption of 507.64 tons at a cost of $1,015.28. For the axle dynamo system, using the same method of figuring we would have 6,545,910 ton-miles with a coal consumption of 654.59 tons at a cost of $1,309.18.

LAMP RENEWAL COST.

Head-End System.—As the battery charging for the sample trains under this system was figured as being done on the road by boosting the voltage on the night circuit lamps, the number of lamps burned out per month will be rather high. Records kept have shown a mortality of 25 per cent. per car per month. With our sample trains each having 389 lamp bulbs, or a total of 778 for the pair of trains, we would have to renew 194.5 lamps per month, having an average value of 20c. each. This would make the yearly lamp bill for the two trains $466.80.

Straight Storage System.—With this system the lamp mortality is a minimum as very seldom does the lamp voltage rise above normal. Records have shown a mortality of about 8 per cent. per car per month. Figuring as above, the lamp mortality for the two trains would be 746 bulbs at a cost of $149.20 per year.

Axle Dynamo System.—The tests conducted by Mr. Wray showed that even though a lamp resistance is employed when the lights are lighted from the generator, there are periods when the lamps are required to take an excessive voltage. This is especially evident when all but the night circuit lights are cut out and the dynamo is charging the batteries. Records have shown a lamp mortality for axle dynamo cars of practically the same figure as under the head-end system quoted above—25 per cent. per car per month. This gives a yearly bill of 2,334 lamp bulbs at a cost of $466.80 for the pair of trains.

BATTERY DEPRECIATION COST.

For the head-end system and the straight storage system the writer would estimate the life of the average storage battery to be five years of service for train lighting and then several more years' service as fan batteries or for private car work. Take depreciation at 15 per cent. for five years, and then 25 per cent. of the original cost as the scrap value of the batteries for fan service.

With the axle dynamo system the life of the batteries is an extremely variable quantity. Instances have occurred where batteries have gone to pieces in 18 months, while in other instances after three or four years of service the batteries were still in fair shape. Assume 20 per cent. depreciation for four years and a scrap value of 20 per cent. at the end of the four years for service as fan batteries.

MAINTENANCE COST.

Under this head include cost of electrical attendance on the road or in passenger yards, repairs, oil, waste, etc.

Head-End System.—The largest single item for this system will be train electrician attendance. On one road where the baggagemen run the dynamos and the trainmen are required to look after the train line connections between the cars, the baggagemen are paid $20 per month extra in addition to their regular rates as baggagemen. As our sample train would require a pool of four baggagemen, the attendance cost would be $80 per month, or $960 per year, if handled by baggagemen.

With regular train electricians the pair of trains would require 2½ men. By the fraction is meant that each of two regular train electricians would be relieved at regular intervals by a substitute from the yard electricians or an extra man. Then each regular electrician would make 146 round trips per year with 73 trips by the extra man. Figuring these men at $1,000 per year each, the attendance cost would be $2,500 per year for the two trains.

The yard attendance for the head-end system would be fairly placed at three hours per day at each terminal, or a total of six hours at 25c., or $1.50 per day. This makes a yearly bill of $547.50 for the pair of trains. This would include testing out the car circuits, renewing burned-out bulbs, flushing and cleaning batteries, etc. Repairs to the generator set, train line connectors, broken battery jars, etc., could be safely placed at $300 for the two trains per year.

Another item for the head-end system would be the steam hose cost. Assume that the generator is located in one end of the express car on the sample train. Then between the locomotive tender and the front end of the express car, remembering that there is a mail car intervening, there will be a total of four steam hose per train, subjected to steam pressures varying from 80 to sometimes 125 lbs. gage. The average life of hose under these conditions is about 1½ months. This means that each hose will have to be renewed eight times per year. Then the yearly bill would be 64 steam hose at a renewal cost of $1.25 each, or a total of $80.

With the generator set placed crosswise of the car the daily oil and waste bill would be 2 qts. engine oil, 1 qt. valve oil, and 1 lb. waste at a cost of 45c. per day, or $164.25 per year for the two trains. With the generator placed lengthwise of the car the oil bill would be cut in half.

Straight Storage System.—The largest single item under maintenance cost under this system would be the employment of a regular man at each terminal for charging purposes. However, this man could test out the car circuits, renew burned-out bulbs, flush and clean batteries and make all necessary repairs. Two men at $2.50 per day would give a yearly bill of $1,825. Broken battery jars, repairs to train line connectors, etc., would probably be safely covered by $100 per year for the two trains.

Axle Dynamo System.—For this system for yard attendance, 30 minutes per car for one electrician to test out the circuits, renew bulbs, test out the regulator, look over the batteries and the generator when necessary would probably be a safe figure. This for an eight-car train would mean four hours a day at each terminal, or a total of eight hours at 25c., or $2 per day, or $730 per year for the pair of trains. A figure of $5 per car per month would be conservative to cover all repairs to the generator, regulators and suspensions, also renewals of broken battery jars, lost belts, etc. The size of this bill will depend considerably upon the ability of the men handling the cars, both in the yards and on the road. An axle dynamo in careless or inexperienced hands is an expensive proposition, and there is no doubt whatever in the mind of the writer that a railroad will make a very serious mistake in employing cheap help to take care of axle dynamos. Using the figure of $5 per car per month, we have a yearly bill of $960 for the 16 cars in the two trains. For the axle dynamos on the sample train the oil bill would be about ½ pint of engine oil per car per round trip with oil at 45c. per gal. Then for the 16 cars the daily bill would be 2 qts. at a cost of 22½c. This would give a yearly bill of $82.12.

Before summarizing the various items under cost of operation it should be noted that there is one point of cost which cannot be estimated, namely, the value of the room displaced in the baggage car by the generator set under the head-end system. On one installation employing a high-speed reciprocating engine set, a distance of about 12 ft. at one end of a 60-ft. car was occupied, while on another road a 15 k.w. turbo-generator set was partitioned off with stanchions in one corner of the car in a space 3 ft. 6 in. x 8 ft. With a 25 k.w. turbo-generator set placed crosswise of the car a minimum distance of 6 ft. at one end of the car will be required. The same generator placed longitudinally will require 8 ft. 6 in.

DEPRECIATION COST OF ELECTRICAL EQUIPMENT.

As the wiring and fixtures are common to all three systems and are essentially a part of the car, no depreciation charge will be made on them.

With the head-end system the principal electrical equipment—the generator set and fittings—is enclosed from the weather in the baggage car and with regular train electricians receive the care which is their due. Therefore 5 per cent. would probably be a safe figure.

With the axle dynamo system the generator itself, which is the principal item of the electrical equipment, is carried in an extremely exposed place and is subject to varying conditions of weather and track. For the generator and suspension 15 per cent. depreciation, and for the regulator 5 per cent. depreciation, would be safe figures.

Instead of dividing the depreciation up the writer has assumed an average figure of 10 per cent. for the generator, regulator and suspension.

Cost of Operation.

Head-end System:	
Current cost	$2,323.38
Weight cost	605.90
Interest on investment at 5 per cent.	699.40
Depreciation on turbo-generator and fittings at 5 per cent.	180.00
Depreciation on batteries at 15 per cent.	664.20
Train electrician attendance	2,500.00
Yard electrician attendance	547.00
Lamp renewals	466.80
Oil and waste	164.25
Repairs	300.00
Steam hose cost	80.00
Total 16 cars	$8,530.93
Average for one car	533.18
Straight Storage System:	
Current cost	$4,071.15
Weight cost	1,015.28
Interest on investment, at 5 per cent.	858.80
Depreciation on batteries at 15 per cent.	1,574.40
Yard attendance	1,825.00
Lamp renewals	149.20
Repairs	100.00
Total for 16 cars	$9,593.83
Average per car	599.61
Axle Dynamo System:	
Current cost	$2,043.20
Weight cost	1,309.18
Interest on investment at 5 per cent.	1,338.80
Depreciation on axle dynamos, regulators and suspension, average at 10 per cent.	1,072.00
Depreciation on batteries at 20 per cent.	2,099.20
Yard attendance	730.00
Lamp renewals	466.80
Repairs	960.00
Oil	82.12
Total for 16 cars	$10,101.30
Average per car.	631.33

In conclusion, it will be noted that for the pair of sample trains chosen the order of preference as to first cost and cost of operation would be: First, the head-end system; second, the straight storage system, and third, the axle dynamo system. It does not necessarily follow, however, that in all cases the head-end system would be most advantageous. Instances have occurred where all three systems were used on one train.

An important feature of electric train lighting from the standpoint of the traveling public is uniformity of voltage at the lamps. A drop of a few volts below the normal voltage will cause a very annoying decrease in the candle-power of the lights. In respect to ability to maintain a constant lamp voltage the first choice undoubtedly rests with the head-end system, as with first-class electricians there is no reason why a predetermined voltage cannot be maintained. With the axle dynamo system the two main factors controlling the voltage at the lamps are the number of lights burning and the condition of battery charge. In some axle systems these factors are taken care of better than in others, but even in the best some variation in lamp voltage will result. From the nature of the storage battery itself the voltage at the lamps with the straight storage system is a maximum when the train first starts out and then gradually falls as the batteries discharge. The higher the capacity and the more fully charged the batteries are the less will be this voltage drop and resulting decrease in candle-power.

As the total tonnage of the modern passenger train is being steadily increased by the use of larger and heavier cars and more of them, it might be interesting to compare the additional load imposed upon the locomotive boiler, and consequently upon the fireman, by lighting the train electrically by the three systems under discussion. Using a one-way trip as a basis, the additional coal required will be made up of two items: that required to generate the current with the head-end and axle dynamo systems, and that required to pull the additional weight for all three systems, as follows:

	Coal for current		Coal for weight		Total	
	One-way trip.	Per hr.	One-way trip.	Per hr.	One-way trip.	Per hr.
Head-end system	3,182 lbs.	227 lbs.	830 lbs.	59 lbs.	4,012 lbs.	286 lbs.
Storage system	"	"	1,390 "	99 "	1,390 "	99 "
Axle dynamo system	2,800 "	200 "	1,793 "	128 "	4,593 "	328 "

For dining cars, parlor cars, mail cars, or any individual car for that matter that is to be electric lighted and is required to be used on more than one train or pair of trains, the writer would recommend the axle dynamo system. The main features of this system is that each car is a complete unit in itself and is not tied down to any given locality.

For the straight storage system the main features are simplicity of operation while on the road and the least number of parts to maintain.

An important field which will probably develop for the head-end system will be the lighting of suburban trains. As a rule no changes in locomotives or cars are made on suburban runs and hence no batteries would be necessary. A 15 k.w. turbo-generator could be placed on top of the locomotive boiler and run by the engineman with but little more trouble than the present electric headlight sets. For protection purposes an extra locomotive could be fitted up with the necessary wiring and piping and a suitable saddle casting so that in an emergency the turbo-generator could be readily transferred from the regular locomotive to this protection locomotive and the wiring and piping connected up in a short time. The first cost for fitting up a locomotive with a 15 k.w. turbo-generator would be about $1,420 and for the protection locomotive $160.

Using a 2/0 wire train line with plain and simple socket fixtures placed along the lower deck crown mould with the wires run in the moulding the cost for wiring the average 50 to 60-ft. suburban car would be about $150. Figuring one locomotive to six cars, the total cost per train of six cars would be $2,480, or an average of $413.33, which figure would compare very favorably with either Pintsch or acetylene gas.

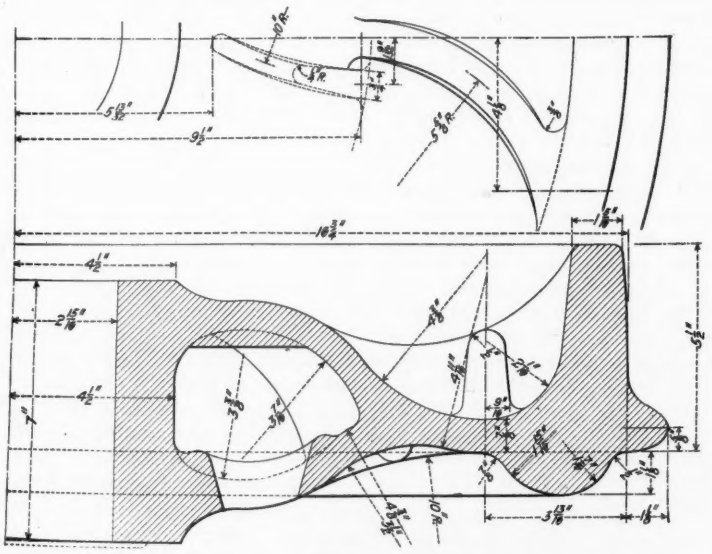
As to the cost of operation: With the turbo-generator on the locomotive full boiler pressure could be used with but a short length of pipe between the boiler and the inlet valve and thus some economy be effected in the steam consumption. With no batteries to maintain or cause trouble the main items of expense would be extra coal at the locomotive, lamp renewals, repairs to train line and turbo-generators, and some roundhouse electrician attendance. Assume a suburban train of six cars, each car having 24-16 c.p. lamps and burning the lamps for a period of six hours per day. A conservative estimate per car per year would be as follows:

Interest on investment at 5 per cent.	$20.65
Depreciation and repairs to locomotive, generator and equipment at 15 per cent.	35.50
Current cost—coal	49.25
Lamp renewals	4.80
Oil and waste	10.00
Yard electrician, attendance and repairs.	18.00
Total cost per car per year	$138.20

Reinforced Cast Iron Wheels for the Norfolk & Western.

The excessive stresses that have been put upon wheel flanges by high capacity cars and the breakages resulting therefrom, have led to a number of attempts to strengthen the flange by a modification of the form of the plates and brackets, and still retain the present form of the flange so that it will pass through the standard frogs and guard rails. Among these modifications is the one shown herewith, designed by Mr. John A. Pilcher, Mechanical Engineer of the Norfolk & Western, and from which satisfactory results in service are being obtained.

As will be seen from the engraving, the plates are thrown back to the inside of the wheel and the single plate, instead of coming



Reinforced Cast Iron Wheel; Norfolk & Western.

up to the rim beneath the center of the tread, rises so that its back face is flush with the back of the flange. At a point $3^{13}/_{16}$ in. below the tread it swells back, adding a thickness of 1⅛ in. of metal back of the rim and thus increasing the amount of metal that must be broken through by a crack starting at the throat of the flange. At the flange itself the metal is no thicker than in the ordinary wheel, so that no trouble is experienced with frogs and guard rails.

The front lip of the rim is supported by brackets somewhat deeper and with a longer radius of curvature than those usually put at the back of the wheel. At the back of this wheel there are 15 ribs, as shown, spaced opposite the brackets on the front face, and having the same radius of curvature. In other respects this wheel does not differ in dimensions and form from the standard wheel.

GENERAL NEWS SECTION

NOTES.

The New York Public Utilities Bill was signed by Governor Hughes June 6, and goes into effect July 1.

On April 1, 1907, there were 63 steam shovels on the Isthmus, available for digging the Panama Canal, as against 15 on Jan. 1, 1906.

A tract of 33,000 acres of irrigated land near Huntley, Mont., will be opened to settlers June 26, and is being advertised by the Burlington.

Engineers and firemen on the Canadian division of the Michigan Central have been granted increases of pay ranging for the former from $7.50 to $15 per month.

Through securing the Uxbridge & Blackstone trolley line, June 8, the New York, New Haven & Hartford gained complete control of the traction facilities between Providence and Worcester.

While pursuing two Montana horse thieves, June 9, Sheriff Guy and a posse from Johnson County, Wyoming, shot and killed one of the robbers that held up a Northern Pacific passenger train at Welch Spur recently.

The strikers of the Rogers Locomotive Works, about 250 blacksmiths, have been notified by the American Locomotive Co. that unless the men return to work the company will shut down the Rogers works for all time.

It is said that an agreement has been reached by all the underground and electric railways in London for an advance in fares on July 1, and the motor bus companies are expected to follow suit. The existing rates have not been profitable.

The bill of complaint filed in the Federal courts June 8 upon which a receiver was appointed temporarily to take charge of the affairs of the Chicago-New York Air Line was dismissed June 10 as the result of an agreement between attorneys.

Owing to the ruling of the Interstate Commerce Commission that it is unlawful for express companies to issue franks to employees of railroads, officials of the Rock Island, by order of the President, have turned in their franks to his office.

The new schedule for increased pay of machinists, car men, maintenance of way employees, office men and others on the Intercolonial Railway, with the exception of trainmen, has been approved by the Railway Department, taking effect from April 1.

The Mississippi Railroad Commission has made an increase in valuation of the railroads of the state, approximately about $3,000,000. The Mobile, Jackson & Kansas City is increased from $3,500 and $5,000 to $7,500 per mile, new and old trackage the same.

The Texas Central has given notice to the state railroad commission that it has bought its own sleeping cars, to be delivered on July 1, and has applied for authority to adopt a rate of $1.50 for lower and $1 for upper berths between Waco and Rotan, 268 miles.

The general managers of Chicago have abandoned their attempt to increase their schedules for trains carrying packing-house products between the Missouri river and Chicago from 24 to 34 hours, on account of the packers' protests, and have compromised by making the time one hour longer.

C. V. Wood, who recently resigned as Superintendent of the Wheeling & Lake Erie and Wabash-Pittsburg Terminal at Canton, Ohio, now has charge of the development of the express and passenger business of the street railway lines in Massachusetts controlled by the New England Investment & Security Company for the New York, New Haven & Hartford.

L. F. Loree, President of the Delaware & Hudson, has urged railroad managers to join him in a petition to the Interstate Commerce Commission asking that body to postpone for one year the inauguration of the new uniform accounting system, on the ground it will make it impossible for the railroads to make comparisons in the results of their operation and those of the year previous.

At a hearing on the Baldwin full crew bill (New York) which provides that every freight train containing over 20 cars shall have three brakemen instead of two, it developed that the New York Central, with its signal system, would be put to an unnecessary expense as there would be nothing for the additional brakeman to do; so the Legislature recalled the bill to make the change in the proposed law.

The Pennsylvania Railroad gave notice at the office of the Ohio railroad commission June 7 that it would file the car service rules promulgated by the commission for all business whether interstate or intrastate. All the other railroads of the state have filed the new car service rules, as applying only to intrastate business, asserting that the state commission has nothing to do with demurrage on cars in interstate service.

Letters have been sent by the Interstate Commerce Commission to the officials of all the railroads in the country doing an interstate business requesting information as to the commissions or bonuses paid to those who solicit or route freight or passenger business. The commission is engaged in compiling information respecting these matters so that it may issue a rating covering the entire subject. It is desired that the information be in the hands of the Commission by June 15.

Following the action of the Atlantic Coast Line, noted last week, the Seaboard Air Line has obtained a temporary injunction restraining the Georgia railroad commission from putting into effect a reduction of 10 per cent. on freight rates of the Seaboard Air Line until the final hearing on June 27. As protest against such reduction, the road says that much of its mileage is new or else composed of weak local roads and that it will have to spend large sums of money for several years in putting equipment in order.

At a conference to-day of presidents and other executive officers of railroads in Illinois and other states it was decided that no special reductions in rates shall be made until the courts have decided whether the 2-cent fare laws recently enacted are valid. The presidents of the roads agreed to notify their attorneys to confer and decide at the earliest date possible upon the manner in which test cases shall be instituted to determine the constitutionality of the two-cent fare laws of Illinois, Indiana, Iowa, Nebraska, Arkansas and Missouri.

Wisconsin's Public Utility bill, which has the support of the two committees of the assembly and senate, was passed by the assembly June 7. The measure puts all public utilities, except the telegraph and telephone, under the control of the state railroad commission. This commission will have power to direct the nature of the service to be rendered, the rates to be charged, and the commission has the right to say whether or not new companies shall be allowed to begin business. The corporations did not oppose the measure, declaring that they desired efficient regulation, and would be glad to be able to keep out of politics.

Attorneys for the Great Northern, appealing from a fine of $15,000 for granting rebates, declare the passage of the Hepburn law estopped prosecutions or rebating under the provisions of the Elkins law. They hold that the Hepburn law repealed the Elkins law, and that the proviso enacted to the effect that suits then instituted and pending under the Elkins law are not to be affected by the passage of the Hepburn law constituted the sum total of the Government's rights to prosecute under the law. The Government contends that it is acting under the so-called "saving clause," which gives it a right to prosecute under the Elkins law violations which occurred during the period that law was in force.

By a decision of the Georgia railroad commission, announced June 7, a flat reduction in the railroad passenger rates of the state was made, Commissioners H. Warner Hill and O. B. Stevens favoring the flat reduction and Commissioner Joseph M. Brown making a minority report. The rates established by the decision are as follows:

Flat two-cent rate for the Atlanta & West Point and Western & Atlantic.

A flat two-and-a-quarter-cent rate for the Atlantic Coast Line and the Georgia Railroads.

A flat two-and-one-half-cent rate for the Central of Georgia, Southern, Seaboard Air Line, Georgia Southern and Florida and the Alabama Great Southern.

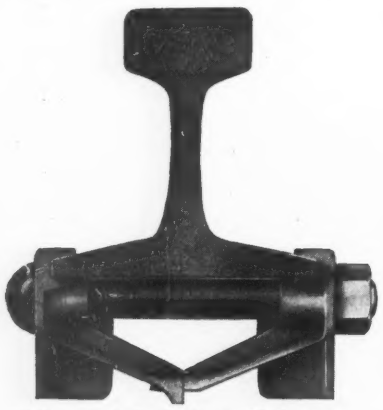
All other roads in the state, with few unimportant exceptions, will charge the present rate of three cents per mile.

A decision in the suit for a mandamus by the Pitcairn Coal Company of West Virginia to compel the Baltimore & Ohio and other companies to refrain from discriminating in distributing cars along the Monongah division of the road was given June 11 by Judge Morris in the United States Court. He stated that he would issue a mandamus requiring the railroad company to cease from excluding individual cars from its basis of computation in ascertaining the

number of cars to which each mine is entitled as its percentage of the car supply. On all other points the mandamus was denied. Judge Morris decided that the individual cars belonging to the coal mine operators and run regularly on the railroad should be counted in as part of the general supply of coal cars in ascertaining the pro rata distribution of cars to the different mines upon a percentage basis when there is a shortage of cars.

The "Vise-Grip" Rail Anti-Creeper.

The "Vise-grip" rail anti-creeper is illustrated herewith. In it the castings are simply carried downward to a meeting point under the rail, forming a fulcrum or foot, with the bolt pulling between it and the jaws above. This construction causes a tightening of the cross-bolt to put a direct and vise-like grip of the hook castings directly and squarely against the rail base, the extent of this grip being limited by the power applied to the bolt. The result is a direct, powerful and rigid clasp.

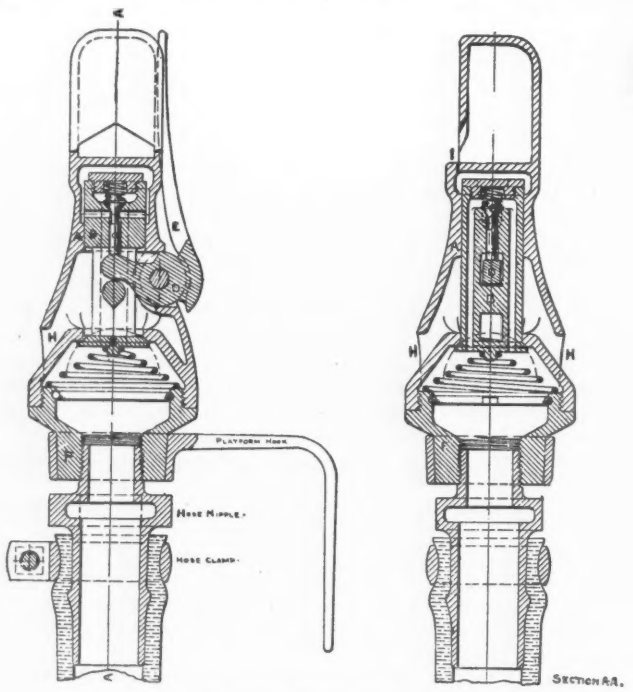


"Vise Grip" Rail Anti-Creeper.

The downward extension of the castings to unite underneath the rail forms a brace and truss support to the sides, adding stiffness and strength where needed, and permitting the extreme pressure of the bolt to be applied directly to the grip. Where the extension braces meet under the rail, a lug on the foot of one jaw engages in a socket in the other, holding both rigidly and in the right position for application. The device is claimed to combine the acme of holding power on the rail, the greatest tie surface and strength of grip, together with ease and quickness of application. It is patented by T. L. Paine, Milwaukee, Wis.

The "Security" Back-Up Valve.

A compact and positive-acting device for sounding a warning whistle, or applying the brakes from the rear platform when backing into terminals, is shown in the accompanying illustration. There are two valves in one, both worked with one handle. The brakes are set by the larger valve with a forward movement of the handle, and the whistle is controlled by the smaller valve with a backward movement of the handle. The whistle valve allows only a small amount of air to be used, and it is impossible to set the brakes unintentionally while blowing the whistle. The brake valve will apply the brakes as gradually as may be desired, and has ample exhaust area for a quick emergency application. Its action is at all times under perfect control.

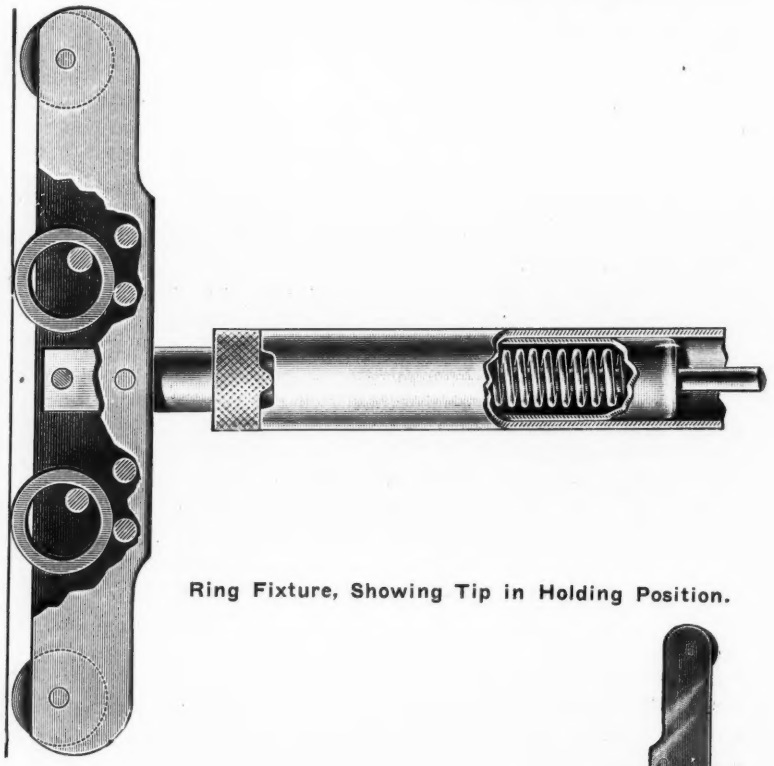


Sections of the "Security" Back-Up Valve.

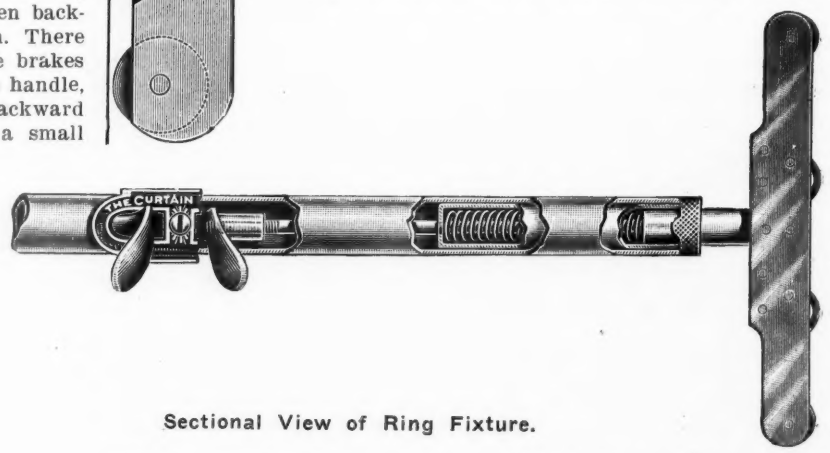
The ease and rapidity with which this valve can be manipulated is not possible with the plug-cock type of valve. It is simple and minimizes repair charges. For regular train service the back-up valve is attached to a section of hose with coupling, making it portable. For observation and private cars it may be connected permanently to the train pipe. It is useful as part of the regular caboose equipment on freight trains, as they often back through crowded stations. This valve is made and sold by Adreon & Co., St. Louis, Mo., and will be sent to railroads on 30 days trial.

The Ring Fixture for Car Curtains.

A new fixture for car curtains, for which simplicity and effectiveness are claimed, is illustrated in the accompanying engravings. It is called the "ring" fixture and is made by the Curtain Supply Co., Chicago. Its internal construction is the same as the Forsyth roller-tip fixture, including its adjustable and locking features. The ring fixture can be operated by grasping the curtain anywhere along the bottom and it is immaterial whether the grooves are rough or smooth, varnished or unvarnished. The principle of the ring fixture is new.



Ring Fixture, Showing Tip in Holding Position.



Sectional View of Ring Fixture.

One of the illustrations shows the head of this fixture in its holding position. The upward tendency of the curtain causes the two little rings in each shoe to rock or jam against the bottom of the grooves, and no jar or movement of the car can make the fixture creep upwards. At the same time the curtain can be pushed up or pulled down by the hand without injuring the fixture or forcing it out of the grooves. When the curtain is thus moved the little rings recede or rock away from the groove bottoms and the fixture then rests on the anti-friction rollers at each end of the shoes and is free to run in an easy manner. The moment the hand is taken away from the curtain the upward pull commences and the rings immediately rock against the groove bottoms and hold the fixture firmly in place. A large number of these fixtures have been in use during the past year and have apparently given entire satisfaction.

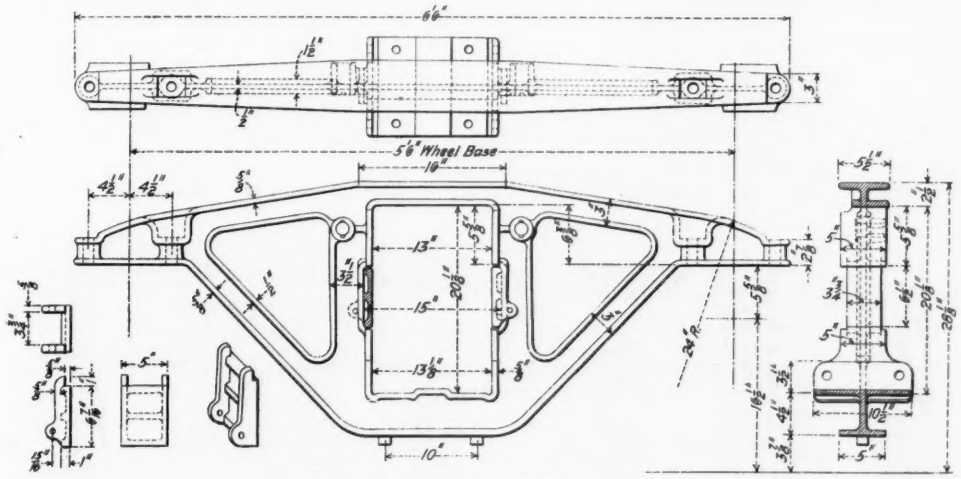
Two More Complaints Settled Out of Court.

The Interstate Commerce Commission in the case of E. M. Wilhoit vs. the Missouri, Kansas & Texas and the St. Louis & San Francisco alleging that the rate on refined oil from Erie, Kan., to Springfield, Mo., was unreasonable of itself and as compared with the rate on such commodity from Erie to St. Louis, Mo., and from

Neodesha, Kan., to Springfield, has dismissed the complaint, because after the hearing the defendants made the rate from Erie to Springfield the same as the rate from Neodesha to Springfield and from Erie to St. Louis. The Commission dismissed the complaint for the same reason in the case of Miller Brothers vs. the Atchison, Topeka & Santa Fe, alleging that rates on hogs and cattle from Bliss, Okla., to Kansas City and St. Joseph, Mo., were unreasonable.

A New Cast Steel Truck Side Frame.

The accompanying drawing shows a new design of cast steel truck side frame which has been applied in large numbers under Pittsburg & Lake Erie cars. The opening in the center is recessed 1 in. on each side to permit the bolster being put in or taken out without dismantling the truck or taking down the sand plank. When



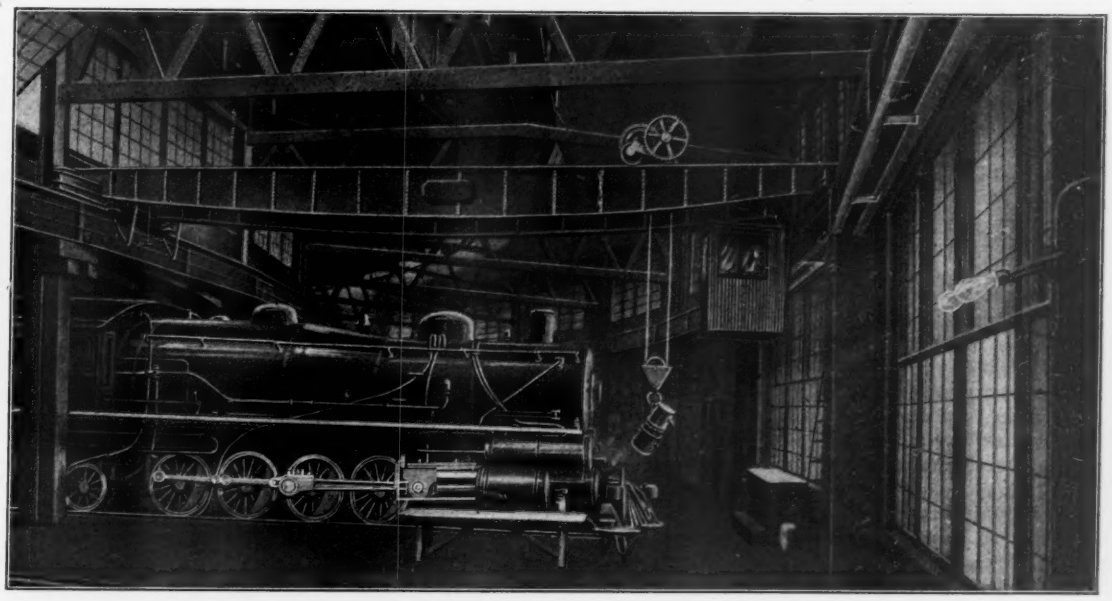
Cast Steel Truck Side Frame.

the bolster and springs are in place these recesses are closed by small fillers, shown in detail, which are locked into place and further held against displacement by a small cotter. To remove the bolster, the springs are taken out, the fillers unlocked and the bolster passed through the widened opening. The frame can be applied to any archbar truck and is suited for any type of bolster. On the Pittsburg & Lake Erie the two angles forming the sand plank are riveted to the under side of the frame instead of being bolted on as is necessary with other designs. The Pittsburg Steel Foundry, Pittsburg, Pa., is the maker.

Electric Overhead Traveling Crane for Roundhouses.

The Atchison, Topeka & Santa Fe has had in service at two of its roundhouses for almost a year the type of overhead electric traveling crane shown in the accompanying illustration. It has all of the functions of the ordinary shop crane of similar type, and spans the house from inner to outer wall. The capacity is 7½ tons and the speeds of the different movements at this loading are: hoisting, 10 f. p. m.; bridge travel, 200 f. p. m. at outer end; trolley travel, 100 f. p. m. The span of the bridge is 45 ft. 11 in.

The special feature of the crane is the provision for proper relative travel of the inner and outer ends of the bridge. This must be in exact proportion to the ratio of the radii of the inner and outer rails, and is therefore accomplished by having the gearing ratios of the two ends in inverse proportion to the ratio of these radii. Horizontal rollers on the trucks of the outer end, bearing against the rail head, prevent possible severe flanging due to imperfections of curvature of tracks or difference in traction conditions. In other respects the crane follows the standard construction of the builder, the Whiting Foundry Equipment Co., Harvey (Chicago), Ill. The essential features of the crane are covered by patents issued to this company. The two cranes referred to are in service at Raton, N. Mex., and Needles, Cal., respectively. Three more are being built for other roundhouses on the Santa Fe system.



Traveling Roundhouse Crane in Roton Shops; Atchison Topeka & Santa Fe.

New York Two-Cent Bill Vetoed.

On June 11 Governor Hughes vetoed the two-cent bill, which had passed the Senate and Assembly, with comment which ought to be read and digested by every state legislative body in the Union.

The Governor in his veto says:

This bill, with specified exceptions, provides for a maximum passenger fare of two cents a mile upon the railroads in this state. Steam railroads less than 150 miles in length which are not within the counties of New York and Kings (or within the limits of any incorporated city) are permitted a higher maximum charge of three, four and five cents a mile, according to length of line, unless through consolidation, lease or control they form part of a system whose combined lines exceed 150 miles, in which case the provision for a maximum rate of two cents a mile is applicable.

The passage of the bill was not preceded by legislative investigation or suitable inquiry under the authority of the state. Nor is the fixing of this rate predicated on reports or statistics officially collated which would permit a fair conclusion as to the justice of its operation with reference to the railroads within its purview. It plainly reflects dissatisfaction with existing conditions and an effort to provide a remedy through arbitrary action. It seems largely to have been the result of annoying requirements and discriminations in connection with the sale of mileage books on certain roads.

The bill represents a policy seriously mistaken and pregnant with disaster. It is of the utmost importance that the management of our railroad corporations should be subject to strict supervision by the state, and that regulations compelling the observance of the law and proper and adequate service should be rigidly enforced. It is the duty of these corporations to provide transportation of passengers and goods at reasonable rates, and the state should compel the performance of this obligation.

But injustice on the part of railroad corporations toward the public does not justify injustice on the part of the state toward the railroad corporations. The action of government should be fair and impartial, and upon this every citizen, whatever his interest, is entitled to insist. We shall make matters no better, but worse, if to cure one wrong we establish another. The fact that those in control of railroad corporations have been guilty of grossly improper financiering and of illegal and injurious discriminations in charges points clearly to the necessity of effective state action, but does not require or warrant arbitrary reprisals. In dealing with these questions democracy must demonstrate its capacity to act upon deliberation and to deal justly.

It is of the greatest importance not only that railroad corpora-

tions should be compelled to respect their public obligations, but also that they should be permitted to operate under conditions which will give a fair return for their service. Upon this depends not simply the security of investors but the security of their employees and the protection of every form of industry and commerce through the maintenance and extension of necessary transportation facilities. Nothing could be more opposed to the interests of the community as a whole than to cripple transportation corporations by arbitrary reduction of earnings.

It may be said that a two-cent passenger rate is not so extreme as to have a very injurious result. But this is a debatable question. Large and prosperous suburban communities have been built up through the offer of commutation rates much less than the proposed maximum. Upon the maintenance of these rates many thousands of our citizens rely. Considerable differences exist between the railroad corporations with respect to the territory they serve and the cost of service, and it is manifest that what would be fair for one might be far from fair for another.

An arbitrary dislocation of tariffs by the fiat of the legislature without investigation is a matter of serious concern. The best that could be said for such legislation would be that it should be regarded as an isolated case and not as a precedent. For if flat freight rates, either for all commodities or for different kinds of commodities, were similarly to be fixed by the legislature without investigation or proper ascertainment of their justice our railroad business and our industrial and commercial interests would be thrown into confusion.

I do not mean to be understood as saying that a maximum two-cent passenger rate would be unreasonably low. It might be high enough in many cases. Possibly it would be high enough in all cases. I fully appreciate the fact that those who have promoted this bill believe that such a rate would be fair. But I deem it most important that the policy of dealing with matters of this sort arbitrarily by legislative rule of general application without reference to the demands of justice in particular cases should be condemned. Every workingman, every tradesman and every citizen believing himself to have aught at stake in the prosperity of the country should determinedly oppose it. For it not only threatens the stability of business enterprises which makes our prosperity possible, but it substitutes unreason for sound judgment, the ill-considered demands of resentment for the spirit of fair play and makes impossible patient and honorable effort to correct abuses.

There is a better way. It has already been pointed out in the legislature of this state. It is practically impossible, in view of the nature of the problems and the many questions requiring consideration, for the legislature to deal directly with railroad rates in a satisfactory manner. Where a matter requires investigation in order that a just result may be reached, the obvious course is to create a body which can investigate with expert assistance as summarily as possible and which shall have adequate power to make appropriate orders. Such a body has been created in this state through the Public Service Commissions law, recently enacted.

Provision is made for inquiry into matters of freight rates and passenger fares and for the fixing of such rates as shall be found just and reasonable. If a passenger rate of two cents a mile is just and reasonable it can be fixed. If it is not just and reasonable it should not be fixed.

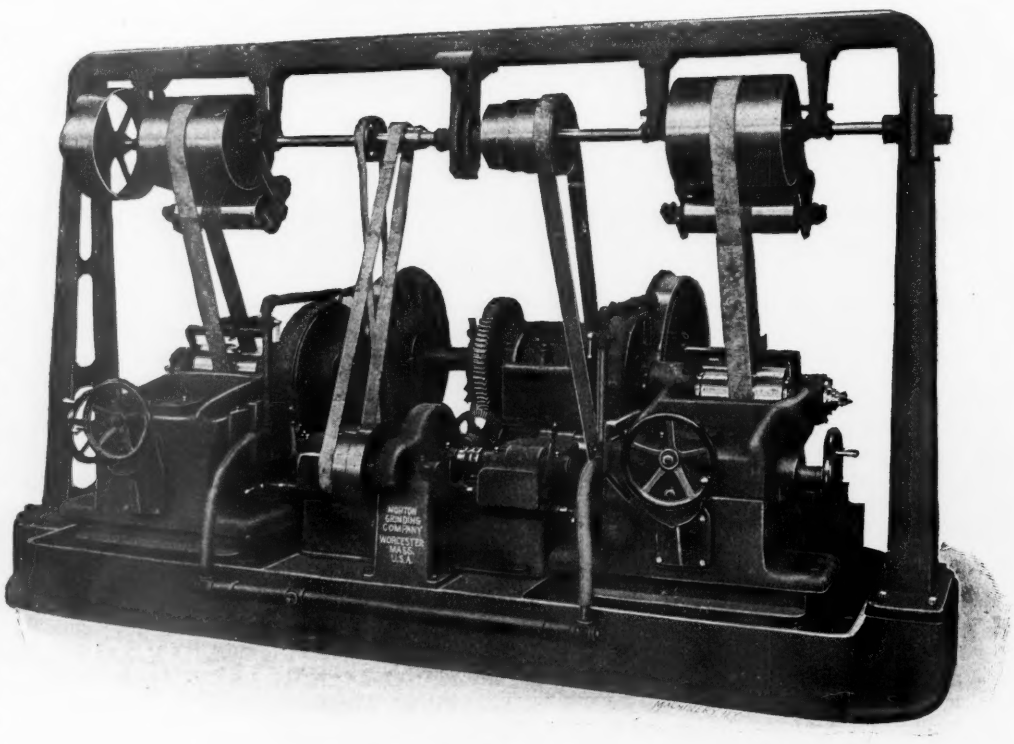
It will be said that this requires time and investigation. But it will not require any longer time or any more protracted investigation than is necessary to reach a right result. The interests of the country are so great and our individual interests are so closely interwoven that it is to the highest degree dangerous to give encouragement to the spirit of impatience with the orderly processes of inquiry.

It may also be said that many other states have adopted similar legislation. If the principle of that legislation be sound we could readily follow the precedent; but if it be unsound there is the greater reason why it should not be followed. The state of New York has provided machinery to settle these questions justly to all with as much despatch as possible. It is to the interest of all that this machinery should be made as perfect and effective as possible. It is to the interest of none that it should be discarded because of preference for arbitrary legislative action.

If this bill were to become a law it would most probably lead in many cases, on account of pretended or real necessity, to economies in service and to readjustment of rates now lower to the annoyance and injury of considerable numbers of the traveling public, for which the gain to others would not necessarily compensate. Again, the validity of such a statute would almost certainly be contested in protracted litigation, the result of which, to say the least, would be in doubt. At a critical time, when the interests of all demand that reason and judgment should control in dealing with such matters, we should have abandoned our true line of action and facilitated still wider departures.

The Norton Car Wheel Grinder.

The accompanying illustration shows a car wheel grinder made by the Norton Grinding Co., Worcester, Mass. This machine will grind car wheels up to 44 in. diameter, and engine truck wheels up to 36 in. diameter. It is arranged with water pump and tank to supply 80 gallons of water a minute, 40 gallons on each wheel. The wheels are ground, while revolving on their own journals, to within .003 in. of true. The machine grinds both new and old wheels, either chilled or steel, at the rate of from 20 to 25 pairs in a 10 hour day. While it is intended particularly for wheels for passenger service, it is claimed that freight wheels ground in this way will cost little if any more than when ground by the old methods. The method of grinding and the rigidity of the machine secures accuracy with minimum expenditure of power and maximum economy of time. The machine is furnished belted complete as shown in the engraving; also with it two grinding wheels that are made especially for this work. The arrangement of overhead works is such that a crane can pass over the machine and the pair of wheels lifted in and out of the journals. The grinding wheel spindles, boxes and wheel head are made particularly heavy to suit the service they are called on to perform.



Norton Car Wheel Grinder.

The operation of that part of the wheel slide that travels parallel with the face of the car wheel is automatic. There is an arrangement to prevent the operator from stopping the slide in the wrong position as related to the flange on the car wheel. The traverse of the grinding wheel across the face of the car wheel is stopped by turning a small handle, shown near the water hose at the left. There is one of these handles at either side of the center for either slide. The revolution of the car wheel can be stopped accurately in the right position for removing it from the worm wheel or drive bearing. The uprights for carrying the car axles while grinding are adjustable for either car wheels or engine truck wheels. The machine can also be built to grind wheels that are not on axles. For this purpose, it is supplied with an expanding arbor; two wheels are mounted, one on either end of the arbor, and both are ground simultaneously. If individual electric drive is used a 30 h.p. constant speed motor is mounted on the overhead works bar, driving the overhead works shaft through a Morse chain and sprockets. The grinder is built for wheels for standard gage road and cannot be changed for other gages. It weighs 31,000 lbs., and is being exhibited at Atlantic City.

The Armbrust Brake Shoe.

A new type of brake shoe for locomotives, tenders and passenger and freight cars is shown in the accompanying illustrations. New principles are embodied in its construction, chief of which are: (1) the shoe is scored at the center to insure the occurrence of accidental breakage at that point where it is least objectionable; (2) spacing lugs on the back of the shoe to space same properly

Car Shoe.

Driver Shoe.

from the brake-head, and (3) a steel connector, which is placed in these spacing lugs instead of in the body of the shoe, which it would weaken. This connector is to hold broken parts—should accidental breakage occur at any point other than the center—firmly in place until worn out, thereby obviating the danger of broken shoes falling on the track.

The scoring of the shoe at the center permits it to adjust itself to the tread of the wheel, insuring good service on the tires and adding to the life of the shoe. Also, it enables the shoe to fit the brake-head at the four points of contact, taking the strain off the shoe and throwing it onto the brake-head where it properly belongs. It is claimed that the body of this shoe, either car or driver, can be worn out right down to the steel connector, and is as safe at the last ¼ in. stage of wear as at the first. The scrap remaining amounts to about 3 lbs. in the car shoe and about 10 lbs. in the driver shoe.

The car shoe is said to be especially well suited to high-speed trains with the heavy air pressure used in this service. Also, provision for holding broken parts, above mentioned, makes it a desirable shoe for elevated roads, since it prevents broken shoes from falling to the street.

The driver shoe is pinned to the brake-head the same as the car shoe, although where desired it can be made to bolt and hook onto the brake-head. On account of the form of construction it is not necessary to have rights and lefts, therefore so large a stock need not be carried; also, as there are no rights and lefts, the shoe, when worn more on one end than on the other, can be turned the same as with car shoes.

This design of shoe, known as the Armbrust, has been adopted as standard by several roads. It is made by the Love Brake Shoe Co., Chicago.

The Law of Supply and Demand.

After centuries of such vain effort to establish the just price for a loaf of bread, for the wages of servants, the rent of land, the rate of interest and many other things, the attempt was generally abandoned before the adoption of our present form of government, since which time prices have been left to the free play of the law of supply and demand. It is to my mind very astonishing that the Congress of the United States should, with practical unanimity, take this distinct step backward, for it will certainly hinder and delay, if it does not in some places absolutely prevent, the development of the West and South through the establishment of new jobbing centers.

It would also seem that under the new law we are to have a valuation of the railroads for the purpose of ascertaining whether or not any of them, and, if so, which, are overcapitalized, and this, apparently, to the end of fixing just rates for railroad freights and fares in proportion to a true valuation. If such valuation were possible, which I doubt, and the fixing in advance by any governmental agency of a just rate were possible, which I deny emphatically, the result will probably be that no railroads will be built in the undeveloped parts of this country, except at the risk and with the capital of existing lines. We are likely to have from the law of 1906 precisely the same experience as was had from that part of the law of 1887 forbidding pooling, from which it has resulted that since 1887 no railroads have been built for a share in the pools, and the only builders of railroads of any magnitude during the last twenty years have been directly or indirectly the large systems then existing or since brought together.—*Stuyvesant Fish.*

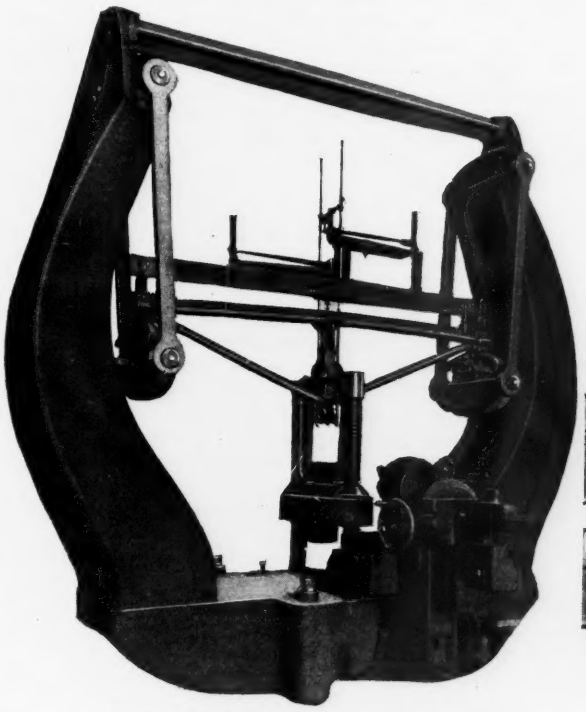
Davis Brake-Beam Testing Machine.

The machine shown in the accompanying illustration was designed with the view of supporting a brake-beam for test under true conditions. The columns on each end of the table of the machine are supplied with bearings at their tops, grooved to receive knife edges which are inserted in the lower edge of the top casting of each swinging link. Similar knife edges are inserted in the top edges of the lower castings of the swinging links, and these knife edges support bearing blocks grooved on the under side to receive them. These bearings in turn carry bearings which support the brake heads, and are adjustable at any fixed angle. The whole adjustment of links is such that a line drawn through the lower and upper knife edges of each link is at right angles with the cone of the center of the tread of the wheel. All the friction being eliminated, the load applied in the line of the pull of the brake-beam develops the outward forces.

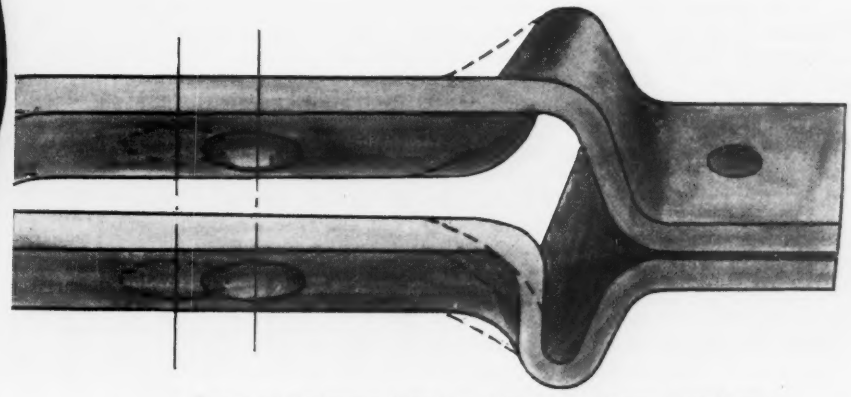
Within each column opposite the lower swinging link casting, the arrangement is such that these swinging links can be held rigidly, showing the difference between testing beams on rigid blocks, and swinging links.

A special frame is arranged with knife edges at either end to rest on the top of brake heads or on the top of an I-beam section, as the case may be, carrying two deflectometers, one deflectometer resting on the center of the top of the beam at mid-span so as to measure the deflection at this point. A second deflectometer carries a cross head with two adjusting screw rods which run downward connecting with a similar cross head at their lower ends, with adjusting screws in the center of each cross head.

By this arrangement, deflections can be taken simultaneously



Davis Brake-Beam Testing Machine.



Form of Fulcrum Used in Testing I-Beam Sections.

both above and below the pin-hole. Investigations with this apparatus demonstrate that while there is practically no change under the load with the truss beams so far tested, it does show a marked increased deflection on I-beams.

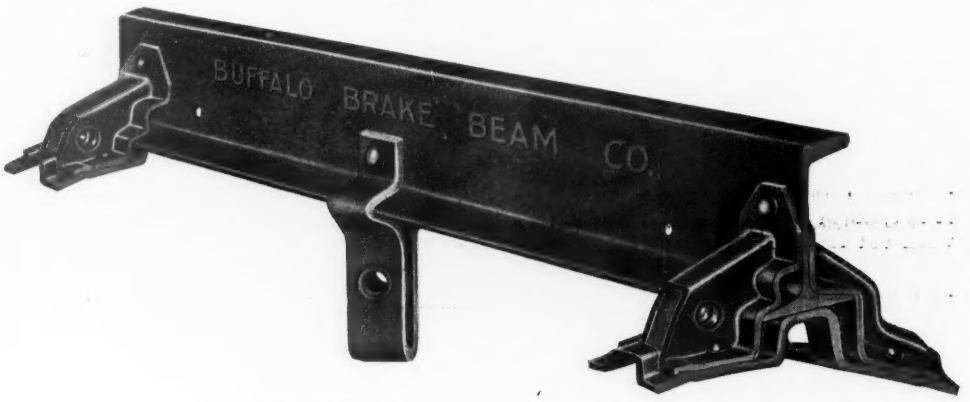
A fulcrum such as is used in brake-beams made of I and similar sections is also shown. Investigation shows that in addition to the measurement taken on the top of such beams, there is additional deflection when measured under the fulcrum for the reason that the fulcrum springs within its length from the center of the pin-hole to the top of the under flange of the beam. The same effect is observable whether the fulcrum is made of malleable iron or forged steel. The machine is being exhibited at Atlantic City by the Davis Solid Truss Brake Beam Co., Wilmington, Del.

Terms of Morse Steamship Consolidation.

Announcement has been made that the stock of the New York & Cuba Mail Steamship Company (Ward Line) may be exchanged for a like amount par value of the 4 per cent. collateral trust bonds of the Consolidated Steamship Company, and also the same amount of stock of that company. Similar terms are offered to all stockholders of the New York & Porto Rico Steamship Company. Most of these stocks have already been exchanged. Shareholders of the Clyde Steamship Company, the Mallory Steamship Company and the Metropolitan Steamship Company were offered these terms some time ago. It is probable that the Hudson Navigation Company will not be taken over by the Consolidated Steamship Company.

Forged Steel Brake Head.

The Buffalo Brake Beam Co., New York, has recently put on the market a new improvement in brake beams. It is a forged steel brake head which conforms to the M. C. B. standards and has the advantages of safety and economy. It frequently happens with the malleable iron head that the key lugs break and let the shoe drop down on the track, usually with serious consequences. With the forged steel head, as will be seen from the illustration, there are no lugs to break, the face of the head forming the bearing surface for the key. An important saving effected by the steel head is the small cost of replacing the separable face plate of the head if it is worn down by contact with the wheel due to the shoe breaking or wearing away; it is not necessary to scrap the entire head. With the introduction of this new feature the company now offers a brake beam every part of which is made of steel—a rolled steel section, forged head, fulcrum, chain clip and wheel guard. Every piece is securely riveted to the brake beam with no loose parts such as bolts, nuts, hooks or keys to work off.



Buffalo Brake Beam With Forged Steel Head.

INTERSTATE COMMERCE COMMISSION RULINGS.

Lower Rates on Peaches; Transportation Cannot be Refused.

The Interstate Commerce Commission, in an opinion by Commissioner Clements, has announced decision in the case of J. J. Waxelbaum against the Atlantic Coast Line and other carriers forming through lines to northeastern destinations from Macon and Atlanta, Ga. The complainant is a commission merchant of Macon, Ga., engaged in buying and selling fruit, especially peaches, and shipping them from points in Georgia to various markets in the North and Northeast. Complaint was made against the carriers' charges from Macon and Atlanta, Ga., to Philadelphia, New York, Washington and Baltimore, including both the charge for carriage and the charge for refrigeration.

The Commission holds that the carriers' charges per 100 lbs. for the transportation of peaches, other than refrigeration, from Macon and Atlanta, of 81 cents to Philadelphia and New York and 78 cents to Baltimore and Washington, and their refrigeration charge of 12½ cents per crate of 42 lbs., minimum carload 550 crates, between such points, are unreasonable and unjust; and that the carriers' practices in using one minimum carload requirement for transportation service other than refrigeration and a different minimum carload for refrigeration service, is also unreasonable and unjust. The Commission holds further that the rate for transportation other than refrigeration to Philadelphia and New York on carload shipments should not exceed 76 cents per 100 lbs., and to Baltimore and Washington 73 cents per 100 lbs., such rates to apply on a carload minimum of 20,000 lbs. for 36-ft. cars and 22,500 lbs. for 40-ft. cars, and that refrigeration charges on such shipments should not exceed 11 cents per crate of 42 lbs. and apply on a carload minimum of 474 crates for 36-ft. cars and 535 crates for 40-ft. cars. The carriers are ordered to make such rates effective on or before July 15, and permission is granted to put them in force on one day's notice. The Commission finds that the carriers' demurrage charge of $5 per day for detention of refrigerator cars by shippers, after expiration of 24 hours free time, and their present rates on less than carload shipments, are not unreasonable or unjust.

The Commission further holds in this decision that under the Rate Law carriers may not lawfully refuse transportation as therein defined, but must on reasonable request afford the same on established rates filed and kept posted as required by law; and that the jurisdiction of the Commission and the purposes of the law cannot be defeated by the omission or failure of carriers to include in their schedules and to keep posted and open to public inspection the rates, fares and charges for the entire service, both transportation and refrigeration, which under the law they are bound to provide.

Reconsigning Charge at Kansas City Upheld.

The Interstate Commerce Commission in an opinion by Commissioner Clark has announced decision in the case of the Board of Trade of Kansas City, Missouri, vs. the Chicago, Burlington & Quincy, Missouri Pacific, Atchison, Topeka & Santa Fe, and Chicago, Rock Island & Pacific. On complaint that the carriers' reconsigning charge of $2 a car on grain shipped to Kansas City and from Kansas City to other markets, is unreasonable and unjust as compared with the reconsigning practices at St. Louis, Minneapolis and Chicago, it appeared that the cars are held by the carriers bringing grain into Kansas City on their "hold tracks" for inspection, sale and reconsignment order, with 48 hours free time before demurrage accrues; that this involves additional service, labor and expense to the carriers and is a valuable privilege to Kansas City dealers, involving also withholding cars from other shipments for the time so detained; that this charge is absorbed by the carrier when reconsigned over its own line, and by other carriers when reconsigned over their lines, when the destination is a competitive point with another line from Kansas City, except by the Chicago, Rock Island & Pacific, which makes no distinction as between competitive and non-competitive destinations; that when grain is milled or consumed in Kansas City the milling is used by shippers to claim absorption of the charge on some other car that does go forward from Kansas City; that any reconsignment charge not absorbed by the carrier is charged back, by the Kansas City dealer, against the country shipper of the grain; that some roads do make a reconsignment charge at St. Louis and Chicago, and that at Minneapolis a charge of $2 a car, called a "running through charge," is assessed, when a car is set at an elevator or a mill and is ordered to another destination without being unloaded. The Commissioner holds that the reconsignment privilege is apparently wholly in the interest of the grain dealers and of Kansas City as a market, and that the reconsignment charge of $2 a car as applied by the carriers is not excessive, unjust or discriminatory.

Local Differentials in New Jersey.

The Interstate Commerce Commission in an opinion by Chairman Knapp has announced decision in the case of Eber De Cou vs. Pennsylvania Railroad; Pennsylvania Company, and Pittsburg, Cincinnati, Chicago & St. Louis. It appears from the evidence that the present difference in through rates per 100 lbs. on grain, flour and feed, carloads, from Chicago and other western points to Mount Holly and Pemberton, N. J., is 5 cents, Mount Holly taking the rate to New York and Pemberton, six miles east, the New York rate plus 5 cents. Prior to February, 1903, the Mount Holly rate was the New York rate plus 3 cents, and for a long period the differential against Pemberton in favor of Mount Holly was 2 cents. The Mount Holly rate was reduced on account of developed water competition. Under the 5 cent differential, complainant could save about 2.5 cents per 100 lbs. by shipping to Mount Holly and teaming to Pemberton. Since the hearing the Pennsylvania Railroad has put in a tariff naming a reconsignment charge on the traffic of 2.5 cents (50 cents per ton) from Mount Holly to Pemberton. The Commission holds that the present through rate to Pemberton as compared with the rate to Mount Holly is excessive and subjects Pemberton to unreasonable prejudice and disadvantage, that the through rate to Pemberton should not exceed the New York rate plus 2 cents per 100 lbs., and should not be at any time more than 2 cents above the rate to Mount Holly.

Manufacturing and Business.

The Dayton Pneumatic Tool Co., Dayton, Ohio, has received a large order for "Dayton" pneumatic chipping and riveting hammers from Sweden. Orders have also been received recently from Eng-

land, Italy and Canada, all of which indicates a satisfactory increase in foreign business.

Dodge & Day, Engineers and Constructors, Philadelphia, are putting up new buildings to be entirely of reinforced concrete for S. L. Allen & Co., at Fifth and Glenwood avenues, Philadelphia. The centering has already been removed from the two lower floors so that machinery can now be installed.

At a special meeting of the directors of the Joseph Dixon Crucible Company, Jersey City, N. J., on May 31, to take action on the death of Vice-President and Treasurer John A. Walker, George T. Smith was elected Vice-President, George E. Long Treasurer, and Harry Dailey a Director and Secretary.

The Westinghouse Automatic Air & Steam Coupler Co., St. Louis, Mo., is exhibiting its device in space No. 1,233 on the steel pier at the M. M. and M. C. B. conventions at Atlantic City. This equipment for automatic coupling of air and steam lines on cars has been fully described in the *Railroad Gazette*.

At the Master Mechanics' Convention at Atlantic City the Goldschmidt Thermit Company, New York, exhibits three sizes of its new fire-brick molds for welding locomotive frames. These molds do away entirely with the services of molders and pattern-makers, allowing the repair to be made in the roundhouse or repair shop. Daily demonstrations of the welding of locomotive frames are given in connection with the exhibit.

About 15,000 tenders, coaches and freight cars are now equipped with Harvey friction draft springs, made by the Frost Railway Supply Company, Detroit, Mich. The roads using them include: Chesapeake & Ohio; Delaware, Lackawanna & Western; Hocking Valley; Illinois Central; Missouri, Kansas & Texas; Chicago, Milwaukee & St. Paul; Chicago, Rock Island & Pacific; New York, Ontario & Western; Pittsburg, Shawmut & Northern, and Bessemer & Lake Erie.

The Chicago, Burlington & Quincy, on June 10, opened a new city ticket office in the Commercial Bank building at 211 Clark street, corner Adams street, Chicago. The walls of the room from floor to ceiling are panelled with mahogany with a panelling of the same wood around the ceiling. Three electric sunburst ceiling lights each 6 ft. in diameter made of bronze and fitted with opalescent glass furnish the general illumination. This is one of the best appointed ticket offices in the country.

The American Car & Equipment Co. has its shops at Chicago Heights, Ill., in full operation and is doing a large amount of repair and rebuilding work. The plant has a good location, being at Twenty-sixth street and East End avenue, directly on the tracks of the Chicago & Eastern Illinois and the Chicago Heights Terminal Transfer Railroad, which connects with all the trunk and belt lines entering Chicago. Although these shops have been in operation but a short time a large amount of business is booked and the company is preparing to double its capacity.

Alfred R. Kipp, formerly Master Mechanic of the Wisconsin Central, recently joined the engineering staff of The Arnold Company, Chicago. Mr. Kipp is a specialist in railroad shop work. He graduated from Purdue University in 1886 and received the degree of M.E. from the same institution in 1899. He served his apprenticeship on the Pennsylvania Lines from 1896 to 1900 and was then made assistant engineer of motive power of the Pennsylvania Lines, Southwest System, at Columbus, Ohio. In February, 1901, he was made general foreman of locomotive repairs at Dennison, Ohio. In June of the same year he went to the Wisconsin Central as Master Mechanic at Fond du Lac, where he remained until entering the employ of the Arnold Company. He is a member of the American Society of Mechanical Engineers, Railway Master Mechanics Association and the Western Railway Club.

Iron and Steel.

Bids are wanted June 25 by the National Transcontinental Railway Commission of Canada for furnishing 65,371 tons of 80-lb. rails, open hearth or Bessemer, and the necessary fastenings to be used on the Grand Trunk Pacific. Bids are also asked on the same date for the construction and erection of five steel bridges.

OBITUARY NOTICES.

John A. Grant, formerly Vice-President and General Manager of the Texas & Pacific, died at his home at Atlanta, Ga., on June 7. Mr. Grant was 70 years old.

Alexander W. Mackenzie, Treasurer of the Canadian Northern, the Canadian Northern Ontario, the Canadian Northern Quebec, the Halifax & Southwestern and the Inverness Railway & Coal Company, and the son of William Mackenzie, President of the Canadian Northern, died at Toronto on June 5 from heart failure following an operation for appendicitis. He was 30 years old.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

The Engineers' Club of Philadelphia.

At a meeting of this club June 1 a paper was read on "Ball and Roller Bearings in Practical Operation," by Mr. S. S. Eveland. The paper was discussed by Messrs. Christie and Hering.

American Society for Testing Materials.

This society, affiliated with the International Association for Testing Materials, will hold its tenth annual meeting at Atlantic City, N. J., June 20 to 22. Headquarters will be at the Hotel Chalfonte. Special hotel rates to members of the society and guests have been secured at $3.50 a day, or $5 with bath, for one person in a room. For two persons sharing a room, the rate will be $3 a day, or $4 with bath, from June 19 to June 23, inclusive.

The programme includes committee reports as follows:

Raw Material Supply. By Messrs. P. H. Knight and C. E. Skinner.
Standard Specifications for Coke. C. H. Zehnder, Chairman.
Purchase of Coal under Specifications and Method of Testing. S. S. Voorhees.
Cast Iron—Some Causes of Failure in Service. Robert Job.
Notes on Brick Pier Test. J. E. Howard.
On Standard Specifications for the Grading of Structural Timber. Hermann von Schrenk, Chairman.
Effect of Moisture on the Strength and Stiffness of Wood. H. D. Tiemann.
The Enforcement of Specifications.
Tests of Concrete Columns. A. N. Talbot.
Notes on Tests of Concrete Columns. J. E. Howard.
Testing of Wooden and Reinforced Concrete Telegraph Poles. R. A. Cummings.
Corrosion of Iron. Allerton S. Cushman.
Influence of Stress upon the Corrosion of Iron. Messrs W. H. Walker and Colby Dill.

CEMENT.

On Standard Specifications for Cement. George F. Swain, Chairman.
Avoidable Causes of Variation in Cement Testing. E. B. McCready.
Some Problems of a Cement Inspecting Laboratory. R. S. Greenman.
Specific Gravity of Portland Cement. R. K. Meade.
Control of Physical Test Results in Portland Cement. W. A. Aiken.
Effect of Oil on Concrete. R. C. Carpenter.
Structural Materials Testing Laboratories, U. S. Geological Survey; Progress During the Year Ending June 30, 1907. R. L. Humphrey.

PRESERVATIVE COATINGS AND LUBRICANTS.

Preservative Coatings for Iron and Steel. S. S. Voorhees, Chairman.
Priming Coats for Metal Surfaces, Linseed Oil vs. Paint. F. P. Cheesman.
Deleterious Ingredients in Paints. L. S. Hughes. Discussion to be opened by G. W. Thompson and F. P. Cheesman.
The Physical Properties of Paint Films. R. S. Perry.
Physical Testing of Varnishes. J. C. Smith. Discussion to be opened by C. B. Dudley, Robert Job and A. H. Sabin.
Paint Legislation. E. F. Ladd.
Standard Tests for Lubricants. A. H. Gill, Chairman.

IRON AND STEEL.

Standard Specifications for Iron and Steel. W. R. Webster, Chairman.
General discussion on Modern American Steel Rails. Discussion is to be opened by representatives of leading railroads, rail manufacturers, locomotive builders, car-wheel manufacturers, and inspecting engineers.
Segregation in Steel Ingots. H. M. Howe.
Effect of Conditions of Rolling on Certain Properties of Steel. H. M. Howe and William Campbell.
The Heat Treatment of Steel. William Campbell.
Mechanical Experiences with Limber and Stiff Rail Sections. P. H. Dudley.
Standard Specifications for Staybolt Iron. H. V. Wille, Chairman.
Results of Tests of Staybolt Iron. E. L. Hancock.
Tempering and Testing of Steel Springs and Standard Specifications for Spring Steel. J. A. Kinkead, Chairman.
Uniform Speed in Commercial Testing. Paul Kreuzpointner, Chairman.
The History and Development of the Alloy Practice in the United States as Applied to Railroad Bearings. G. H. Clamer.
Compressive and Transverse Tests of Steel Connecting Rods for Locomotives. Gaetano Lanza.
Tension Tests of Steel Angles. F. P. McKibben.

CONCRETE, FIREPROOFING AND WATERPROOFING MATERIALS.

Reinforced Concrete. F. E. Turneaure, Chairman.
On Fireproofing Materials. Ira H. Woolson, Chairman.
Investigation of the Thermal Conductivity of Different Concrete Mixtures, and the Effect of Heat upon their Strength and Elastic Properties. Ira H. Woolson.
Effect of Time Element in Loading Reinforced Concrete Beams. W. K. Hatt.
Tests of Twisted Steel Square Rods for Concrete Reinforcement. J. J. Shuman.
Tests of Bond between Steel and Concrete. T. L. Condron.
On Waterproofing Materials. W. A. Aiken, Chairman.

TESTING MACHINES AND APPARATUS.

Standard Methods of Testing. Gaetano Lanza, Chairman.
National Bureau of Standards. S. W. Stratton.
White-Souther Endurance Machine. H. Souther.
Notes on the Endurance of Steels under Repeated Alternate Stresses. J. E. Howard.
Effect of Combined Stresses on the Elastic Properties of Steel. E. L. Hancock.
A New Impact Machine. L. W. Page.
Development of the Penetrometer as Used in the Determination of the Consistency of Semi-Solid Bitumens. Clifford Richardson and C. N. Forrest.
Multiplying Dividers for Locating Yield Point. J. A. Capp.
An Instrument for Measuring Deformation in Tests of Materials. H. F. Moore.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Birmingham & Atlantic.—S. H. Marsh has been elected Vice-President.

Delaware & Hudson.—Cornelius Vanderbilt has been elected a Member of the Board of Managers, succeeding Frank E. Smith, who was elected temporarily at the annual meeting last month.

Abel I. Culver, Second Vice-President, has resigned.

C. S. Sims, General Manager, has been elected also Second Vice-President, succeeding Mr. Culver.

Flint River & Gulf.—T. E. Lovejoy has been elected President, with office at Hawkinsville, Ga.

Licking River.—The officers of this company are as follows: President, H. R. Stone; Vice-President, R. H. Lanyon; Secretary, M. M. Snow, and General Manager, J. W. Morrison.

Live Oak, Perry & Gulf.—J. L. Ensign, Second Vice-President, has been elected President. R. P. Hopkins, General Freight and Passenger Agent, has been appointed Traffic Manager. S. T. Grimshaw has been appointed Superintendent. The offices of all are at Live Oak, Cal.

New York, New Haven & Hartford.—Henry K. McHarg, of Stamford; Frederick F. Brewster, of New Haven; A. Heaton Robertson, of New Haven; Lewis Cass Ledyard, of New York; Charles M. Pratt, of New York, and Richard Olney, of Boston, have been elected Directors, increasing the number of members of the Board from 19 to 25.

Norfolk & Western.—William G. MacDowell, who was recently elected First Vice-President, was born in 1845 at Philadelphia, Pa. He began railroad work in 1868 as a clerk in the Auditor's office of the Empire Transportation Company. He was made Auditor of this company in 1873, and in a few months his authority was extended over the Erie & Western Transportation Company. In 1879 he was made Assistant Treasurer of the Shenandoah Valley, now part of the Norfolk & Western, and was later made Treasurer. Two years later he was made also Treasurer of the Norfolk & Western. In 1883 he was appointed Comptroller of both roads, and in 1887 Treasurer of the Norfolk & Western and affiliated companies. In 1905 he was elected Vice-President and has now been made First Vice-President.

Thomas S. Davant, who was recently elected Vice-President and Traffic Manager, effective July 1, was born at Gillisonville, S. C., and began railroad work in 1865 as station agent on the Charlotte & South Carolina, now part of the Southern. After serving on the Columbia & Augusta and the Charleston, Columbia & Augusta, which are also now parts of the Southern, he was, in 1871, made chief clerk in the General Passenger Agent's office of the last named company. Three years later he was made General Freight and Passenger Agent of the Port Royal Railroad, now part of the Charleston & Western Carolina, and in 1877 went to the Memphis & Charleston as Assistant General Freight and Passenger Agent, and in 1886 was made General Freight Agent of the East Tennessee, Virginia & Georgia; both these roads are now part of the Southern. Four years later he went to the Norfolk & Western as General Freight Agent. In 1903 he was made Freight Traffic Manager, from which position he is now to be promoted.

Rock Island Company.—A. S. Greig, who was recently appointed Assistant to the Chairman of the Board, began railroad work in 1885 on the Denver & Rio Grande. After serving as secretary to the Purchasing Agent he was made secretary to the Superintendent of Machinery, and later was transferred to the operating department as secretary to the General Superintendent; he was made chief clerk and then assistant to the General Superintendent. In 1896 he was appointed Trainmaster of the Santa Fe, Prescott & Phoenix. Two years later he was appointed Superintendent of the El Paso & Northeastern. He was later made General Superintendent and Traffic Manager of that same road, and finally Assistant General Manager, which position he held until March, 1903. During the rest of that year he was out of railroad work, and was engaged in making plans for a new sanitarium in New Mexico. In January, 1904, he returned to railroad work and perfomed special duties in the office of the President of the Chicago, Rock Island & Pacific until the spring of 1906, when he was appointed Assistant to the President of the St. Louis & San Francisco. This position he now leaves to become Assistant to B. F. Yoakum, Chairman of the Executive Committee of the St. Louis & San Francisco and of the Chicago, Rock Island & Pacific, and Chairman of the Board of the Rock Island Company.

A. S. Greig.

Operating Officers.

Birmingham & Atlantic.—George Dunglinson, Auditor and Assistant Treasurer, has been appointed also Superintendent.

Canadian Northern.—E. A. James, General Manager, who was recently given extended leave of absence on account of ill health, has resigned.

Canadian Pacific.—The Western division has been reorganized into three operating districts, as follows: First district: Medicine Hat, Calgary and Lethbridge sections, including Lethbridge terminal, J. S. Lawrence, previously Superintendent at Nelson, B. C., Superintendent, with office at Medicine Hat, Alb., and A. Hobkirk, Trainmaster, with office at Lethbridge, Alb. Second district: Laggan section, including Calgary terminals, Edmondton section, Wetaskiwin and Lacombe branches, J. Niblock, Superintendent, with office at Calgary, Alb.; E. L. Chudleigh, Assistant Superintendent, with office at Strathcona, Alb., instead of Calgary as previously, and T. R. Fleth, Trainmaster, with office at Calgary. Third district: Sirdar, Cranbrook, Crows Nest and Macleod sections, Curzon and Kimberly branches, G. Erickson, Superintendent, with office at Cranbrook, B. C.; J. R. McNabb, Trainmaster, with office at Macleod, Alb.

D. C. Coleman has been appointed Superintendent, with office at Nelson, B. C., succeediug J. S. Lawrence, transferred as above.

Central of Georgia.—C. F. Groves has been appointed Car Accountant, with office at Savannah, Ga., succeeding Theodore Wells, now Superintendent of the Northern Kansas division.

Cleveland, Cincinnati, Chicago & St. Louis.—See Lake Shore & Michigan Southern.

Colorado Southern, New Orleans & Pacific.—The office of General Superintendent has been abolished, and three division superintendents appointed. D. T. Forbes, heretofore General Superintendent, has been appointed Superintendent at Beaumont, Tex. F. S. James has been appointed Superintendent at Opelousas, La. W. W. Yateman has been appointed Superintendent at Orange.

Flint River & Gulf.—H. E. Rodes has been appointed General Manager, with office at Hawkinsville, Ga.

Illinois Central.—T. E. Hill, roadmaster of the Louisiana division, has been appointed Superintendent of the same division, with office at McComb, Miss., succeeding J. F. Porterfield, resigned to go to the Yazoo & Mississippi Valley. T. L. Dubbs, Trainmaster of the Fulton district of the Tennessee division at Fulton, Ky., has been appointed Superintendent of the Nashville division, with office at Nashville, Tenn., succeeding H. J. Scheuing, resigned. G. E. Gallaway succeeds Mr. Dubbs, with office at Fulton, Ky.

Lake Shore & Michigan Southern.—Albert S. Ingalls, Superintendent of the Cleveland, Cincinnati, Chicago & St. Louis at Cleveland, Ohio, has been appointed Assistant General Superintendent, with office at Cleveland, succeeding S. W. Brown, now General Superintendent of the Michigan Central.

Mexican International.—W. F. Sheridan, Superintendent of Transportation, has been appointed to the new office of General Superintendent, with office at C. Porfirio Diaz, Coahuila. M. A. Needham, Trainmaster at Torreon, Coahuila, has been appointed to the new office of Superintendent of the Southern division. J. H. Smith succeeds Mr. Needham. R. J. Schmalhausen, Trainmaster at Monclova, Coahuila, has been appointed to the new office of Superintendent of the Northern division. J. M. Thompson, Assistant Trainmaster at Monclova, succeeds Mr. Schmalhausen.

Missouri, Kansas & Texas of Texas.—R. J. Sullivan, Superintendent of the Fort Worth, Dallas, Denton and Henrietta divisions, and the Sherman, Bonham and Cleburne branches, has been appointed Superintendent of the Shreveport and Mineola divisions and the McKinney branch, with office at Greenville, Tex., succeeding C. H. Scott, Acting Superintendent. Mr. Scott in turn succeeds Mr. Sullivan. A. M. Acheson has been appointed Superintendent at Trinity, Tex., succeeding C. Hammond, assigned to other duties.

New York & Ottawa.—George H. Phillips, General Freight and Passenger Agent, has been appointed Superintendent, succeeding to the duties of S. F. Beamish, Acting Superintendent.

Sierra-California.—B. J. Bouchard, Acting Superintendent, has been appointed Superintendent, with office at Jamestown, Cal.

Southern.—W. R. Hudson, Superintendent of Terminals at Spencer, N. C., has been appointed Superintendent of the Danville divi-

sion, with office at Greensboro, N. C., succeeding C. S. Lake. J. W. Wassum succeeds Mr. Hudson.

Wichita Valley.—O. E. Maer has been appointed Superintendent, succeeding M. E. Jones.

Yazoo & Mississippi Valley.—J. F. Porterfield, Superintendent of the Louisiana division of the Illinois Central, has been appointed Superintendent of the Memphis division of the Yazoo & Mississippi Valley, with office at Memphis, Tenn., succeeding John J. Flynn, resigned to go to the Trinity & Brazos Valley.

Traffic Officers.

Bangor & Aroostook.—The office of R. K. Nickerson, Assistant General Freight Agent, has been removed from Bangor, Me., to Houlton.

Birmingham & Atlantic.—W. M. Tarpley, Assistant General Freight and Passenger Agent, has been appointed General Freight and Passenger Agent.

Chicago, Indianapolis & Louisville.—J. T. Green has been appointed General Agent at Atlanta, Ga., succeeding R. Jackson, resigned.

Denver & Rio Grande.—W. H. Cundey, Traveling Passenger Agent at Denver, Colo., has been appointed General Agent of the Passenger Department at Colorado Springs, Colo., succeeding J. M. Ellison, assigned to other duties.

Great Northern.—The Traffic Department has been reorganized, and the offices of Freight Traffic Manager and Passenger Traffic Manager have been abolished. A. L. Craig, Passenger Traffic Manager, becomes General Passenger Agent, with office at St. Paul, Minn. The office of Freight Traffic Manager has been vacant since the promotion of W. W. Broughton to the office of Traffic Manager.

Missouri, Kansas & Texas.—E. D. Chadwick, commercial agent at Shreveport, La., has been appointed General Agent at Galveston, Tex., succeeding C. L. Fontaine. See Wichita Falls Railway.

Missouri Pacific.—C. McD. Adams, General Agent at St. Louis, has been appointed General Agent at Memphis, Tenn. Charles Rippin succeeds Mr. Adams.

Southern Pacific.—J. T. Keefe has been appointed Assistant General Passenger Agent.

Washington, Idaho & Montana.—Isaac Wilson has been appointed General Freight and Passenger Agent, with office at Potlatch, Idaho, succeeding C. E. Cline, resigned.

Wichita Falls Railway.—C. L. Fontaine, General Agent of the Missouri, Kansas & Texas at Galveston, Tex., has been appointed General Freight and Passenger Agent of the Wichita Falls Railway, with office at Wichita Falls, Tex.

Engineering and Rolling Stock Officers.

Atchison, Topeka & Santa Fe.—J. F. Whiteford is General Roundhouse Inspector, with office at Albuquerque, N. Mex. In the *Railroad Gazette* of May 24, it was stated that J. E. Whiteford, general foreman at Fort Madison, Iowa, had been appointed to the new office. This was an error; J. E. Whiteford remains at Fort Madison.

Baltimore & Ohio.—W. S. Bouton, chief bridge draftsman, has been appointed Assistant Engineer of Bridges and Buildings, with office at Baltimore, Md., succeeding William Graham, resigned.

Canadian Pacific.—E. E. Austin has been appointed Master Mechanic of the Third district, with office at Nelson, B. C.

Central of Georgia.—R. M. Boldridge, formerly Master Mechanic of the Mississippi Central, has been appointed Master Mechanic of the Central of Georgia, with office at Cedartown, Ga.

Chicago Great Western.—W. A. Christian has been appointed Assistant Engineer, with office at St. Paul, Minn.

El Paso & Southwestern.—C. A. Snyder, Master Mechanic of the Gulf, Colorado & Santa Fe at Cleburne, Tex., has been appointed Master Mechanic of the El Paso & Southwestern at Douglas, Ariz.

Gulf, Colorado & Santa Fe.—See El Paso & Southwestern.

Kansas City, Mexico & Orient.—Frederick Mertsheimer, formerly Superintendent of Machinery of the Kansas City Southern, has been appointed Superintendent of Motive Power and Rolling Stock of the Kansas City, Mexico & Orient, with office at Sweetwater, Tex.

Richmond, Fredericksburg & Potomac.—C. W. Haines, Chief Engineer, has resigned, and the office has been abolished.

St. Louis, Brownsville & Mexico.—E. C. Burgess, Acting Chief Engineer, has been appointed Chief Engineer, with office at Corpus Christi, Tex.

John Nicholson, foreman of shops at Kingsville, Tex., has been appointed Superintendent of Motive Power, with office at that place, succeeding H. H. Kendall, resigned.

Toledo, St. Louis & Western.—A. A. Shane, Superintendent of Bridges and Buildings, has resigned. C. L. Kinney has been appointed Acting Superintendent of Bridges and Buildings.

Washington Terminal Company.—C. M. Harris has been appointed Master Mechanic, with office at Washington, D. C.

Western Maryland.—William Miller, formerly Master Mechanic of the Denver & Rio Grande at Denver, Colo., has been appointed Superintendent of Motive Power of the Western Maryland, with office at Union Bridge, Md., succeeding I. N. Kalbaugh, resigned.

Wichita Valley.—W. E. Bogart, Chief Engineer, has resigned to go to the Kansas, Mexico & Orient.

Purchasing Agents.

Isthmian Canal Commission.—David W. Ross, Chief Purchasing Officer, has resigned, effective on appointment of his successor.

Special Officers.

New York, New Haven & Hartford.—A. A. Maxwell, Attorney at Boston, has been appointed Commissioner of Real Estate, succeeding F. C. Fiske, deceased.

LOCOMOTIVE BUILDING.

The St. Louis-Southwestern is asking bids on 25 locomotives.

The Chicago, Rock Island & Pacific is asking bids on 11 consolidation (2-8-0) locomotives similar to the 30 engines ordered to be built at the Brooks Works of the American Locomotive Company last fall.

The Lake Superior Terminal & Transfer has ordered two simple eight-wheel switching locomotives from the Baldwin Locomotive Works for September delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Switching
Weight, total	150,000 lbs.
Diameter of drivers	50 in.
Cylinders	20 in. x 26 in.
Boiler, type	Straight top
" working steam pressure	200 lbs.
" number of tubes	262
" material of tubes	Charcoal iron
" diameter of tubes	2 in.
" length of tubes	13 ft. 5 in.
Firebox, length	44 "
" width	60 "
" grate area	52 sq. ft.
Heating surface, total	2,100 "
Tank capacity	4,500 gals.
Coal capacity	5 tons

Special Equipment.

Air-brakes	Westinghouse
Tires, driving wheel	Midvale

CAR BUILDING.

The Consolidated Railway (N. Y., N. H. & H. Electric Lines) has ordered 79 cars.

The Atchison, Topeka & Santa Fe has ordered three café cars from the Pullman Co.

The Duluth, Rainy Lake & Winnipeg is asking bids on 100 box cars of 80,000 lbs. capacity.

The Toledo, Port Clinton & Lakeside has ordered five flat cars from the Hicks Locomotive & Car Works.

The Buffalo & Lake Erie Traction Company has ordered some interurban cars from the Cincinnati Car Company.

The Chicago Great Western, as reported in the *Railroad Gazette* of May 31, has ordered 1,000 wooden box cars from the Pullman Co.

The Dairy Shippers Despatch, Chicago, as reported in the *Railroad Gazette* of May 23, has ordered 50 refrigerator cars of 60,000 lbs. capacity from the Ryan Car Company.

The Union Railroad, as reported in the *Railroad Gazette* of May 3, has ordered 500 patent steel dump cars and 800 steel hopper cars from the Standard Steel Car Company, and 1,500 steel hopper cars from the Pressed Steel Car Company.

The Detroit & Toledo Construction Co., Harvey, Ill., successor to the Chicago & Southern Traction Co., has ordered 19 ballast cars from the Hicks Locomotive & Car Works in addition to the cars reported in the *Railroad Gazette* of June 7.

The Houston Electric Company, Houston, Tex., as reported in the *Railroad Gazette* of May 24, has ordered 10 semi-convertible passenger cars from the St. Louis Car Company for October delivery.

These cars will measure 28 ft. long, 8 ft. 9 in. wide and 9 ft. 6 in. high, inside measurements.

The Dairy Shippers Despatch, Chicago, has ordered 50 refrigerator cars of 60,000 lbs. capacity from the Ryan Car Co., for August delivery. These cars will be 36 ft. long, 9 ft. wide and 7 ft. 5 in. high, outside measurements. The special equipment includes:

Bolsters	Bettendorf
Brake-beams	Chicago Railway Equipment Co.
Brakes	Westinghouse
Couplers	Major
Draft rigging	Farlow
Journal boxes	Symington

The Canadian Northern, as reported in the *Railroad Gazette* of May 17, has ordered 50 steel ore cars of 100,000 lbs. capacity from the Dominion Car & Foundry Company for July delivery. These cars will measure 26 ft. 7⅛ in. long and 9 ft. 6 in. wide, inside measurements, and 28 ft. 8 in. long, over all. Bodies and underframes will be of steel. The special equipment includes:

Bolsters	Simplex
Brake-beams	Simplex
Brake-shoes	Steel backed
Brakes	Westinghouse
Brasses	Camel
Couplers	Latrobe
Draft-rigging	Miner
Journal boxes	McCord
Paint	Graphite

RAILROAD STRUCTURES.

CHANUTE, KAN.—The Missouri, Kansas & Texas, it is said, has plans ready for putting up a passenger station here to cost $25,000.

EVANSVILLE, IND.—According to J. O. Crockett, of the Evansville & Terre Haute, plans for a new railroad bridge to be built over the Ohio river at this place are being made, to cost about $2,000,000.

PORTLAND, ORE.—The American Bridge Company has orders from the Pacific Railway & Navigation Company for bridges to be built over the Miami, Kiches and Wilson rivers, to cost about $60,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—The Kiowa & Lake City division of the Denyer, Enid & Gulf has been extended from Lake City, Kan., northwest to Belvidere, 17 miles.

BAKERSFIELD & VENTURA.—An officer writes that this company has finished 20 miles of its line projected from San Francisco, Cal., southeast via San Jose, McKittrick, Sunset and Santa Paula, thence southwest via Saticoy and Montelvo to Ventura, on the Pacific coast. A branch is to be built northeast from Sunset to Bakersfield, also a branch from Saticoy south via Oxnard, to Hueneme, on the Pacific coast, a total of 370 miles. A branch is projected from Santa Paula southeast to Santa Monica, thence east to Los Angeles, 50 miles. Contracts for grading and bridges may be let early this fall. The work will include several tunnels and eight or ten bridges. T. B. Blackburn, Chief Engineer, Los Angeles, Cal.

BATON ROUGE, HAMMOND & EASTERN.—See Illinois Central.

BRAZOS VALLEY, BRENHAM & GULF.—This company, incorporated in Texas to build from Brenham northwest to Waco, 131 miles, has given contracts for some of the work. D. E. Teague, of Brenham, is advertising for men to carry out the work, which is to be started this week. (April 26, p. 598.)

BULLFROG-GOLDFIELD.—This road has been extended from Springdale, Nev., south to Beatty, nine miles.

CAIRO & TENNESSEE RIVER.—An officer writes that the projected route of this line is from Wickliffe, Ky., three miles east of Cairo, Ill., east through or near Mayfield, Dexter, Canton, Cadiz, Gracey, Hopkinsville, Elkton, Franklin, Scottsville, Tompkinsville, Albany, Monticello, and Jellico in Kentucky, to Newcomb, Tenn., unless built through Bell County, and Middlesboro, Ky., the road will pass through or near county seats in Tennessee as follows: Jacksboro, Tazeville, Sneedsville, Rogersville and Blountville to Bristol, approximately 465 miles. Underwriting is partially completed for building the three sections from Wickliffe east to Hopkinsville, Ky., 108 miles, and these three sections will probably be finished and put in operation within one year. A large amount of terminal property has been bought and most of the right of way secured and surveys made for 425 miles. Contracts let for the three sections to the Atlantic & Cairo Construction Company, which will probably sublet most of the work, which is ordinary level construction for most of the way to Hopkinsville, with little or no rock work. There are to be two bridges, one about 1,600 ft. or 1,800 ft. long over the Tennessee river, the other about 1,000 ft. long over the Cumberland river. Maximum grades one-half of 1 per cent., maximum curves 3 deg. L. W. Goode, President, 111 Broadway, New York; Charles H. Delano, General Manager at Mayfield, Ky., and E. C. Weston, Assistant General Manager, Wickliffe, Ky.

CANANEA, YAQUI RIVER & PACIFIC.—The Cananea division of this road has been extended from Fundicion southward to Novojoa, 24 miles.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—Local reports state that the old tunnel between Parker, Ill., and Vienna is to be abandoned. New surveys are being made south from Stone Fort and west of the old tunnel, also west of Vienna. The present line extends through the east section of Vienna.

CHICAGO & NORTH-WESTERN.—On June 3 the line of the Chicago & North-Western, which is being built under the charter of the Pierre, Rapid City & Northwestern from Pierre, S. Dak., west to Rapid City, was opened for traffic from Midland. The road was already in operation from Pierre west to Philip, about 25 miles. The western end of the new line is in operation from Rapid City east to Wasta, 45 miles.

CHICAGO, INDIANAPOLIS & EVANSVILLE.—Contract let to the Carter Construction Co. to build this projected road from Chicago south through Indianapolis to Evansville, Ind. J. B. Carter and William Kemfick are the promoters.

GRAND RAPIDS TERMINAL BELT.—An officer writes that this company, which proposes to build a 14-mile belt line around Grand Rapids, Mich., will let contracts in about 30 days for some of the work. The company proposes to finish the first 3½ miles this summer. Samuel Lazarus, President, St. Louis, Mo., and Edward H. Christ, Chief Engineer, Grand Rapids, Mich.

GREAT NORTHERN.—The extension of the branch from Neche, N. Dak., near the international boundary, northwest to Portage La Prairie, 78 miles, has been opened.

GULF, COLORADO & SANTA FE.—On the Jasper & Eastern extension from De Ridder, La., east 45 miles, which was built as far as Cravens last year, grading has been finished on the remaining 25 miles to Oakdale, and track laying is to be started at once. (Mar. 15, p. 384.)

ILLINOIS CENTRAL.—Freight service was recently started on the new connecting line under construction for about two years from Herrin in Williamson County, Ill., north to Ziegler in Franklin County. About 4½ miles of the line was finished last year. The line connects the coal fields of Williamson County with the main line of the Illinois Central at Duquoin. Passenger service will shortly be started over the line.

The Roundaway district of the Memphis division of the Yazoo & Mississippi Valley has been extended from Roundaway, Miss., south to Lombardy, eight miles.

The Baton Rouge, Hammond & Eastern, projected from Baton Rouge, La., east thence northeast to Merrill, Miss., it is said, has been bought by the Illinois Central. L. S. Berg, of Baton Rouge, President of the company, will have charge of building the line from Baton Rouge east to Hammond, 41 miles, for which contract has been let to John Scott & Sons, of St. Louis. (May 24, p. 727.)

IMPERIAL VALLEY.—Incorporated in Texas with $100,000 capital and office at Sartartia. The company proposes to build a line from Sugarland, in Fort Ben County, Tex., northwest paralleling the Brazos river through the counties of Fort Ben and Waller to a junction with the Houston & Texas Central near Hempstead, about 60 miles.

JASPER & EASTERN.—See Gulf, Colorado & Santa Fe.

LAKE CHARLES & SOUTHERN.—See Shreveport, Alexandria & Southwestern System.

LOUISVILLE & NASHVILLE.—The Morganfield branch of the St. Louis & Henderson division from Providence, Ky., north to Morganfield, 26 miles, has been opened for business.

LOUISIANA & PACIFIC.—See Shreveport, Alexandria & Southwestern System.

MISSISSIPPI RIVER & BONNE TERRE.—The Gumbo branch from Elvins, Mo., south to Mitchell, four miles, has been opened for business.

MISSOURI, OKLAHOMA & GULF.—This company has its road in operation from Wagner, Ind. T., south to the Henrietta coal fields and across the Canadian river to Dustin, Ind. T., 75 miles; also a short branch to the coal mines at Karl and at McDonald, two miles. Announcement is made that money has been secured to build the proposed extension from Dustin south to Denison, Tex., 128 miles. The company has also projected an extension north to Joplin, Mo., 120 miles, and a branch west to Shawnee, Okla., 50 miles. (Mar. 15, p. 387.)

MISSOURI PACIFIC.—The Springfield branch of the White River division of the St. Louis, Iron Mountain & Southern from Crane, Mo., northward to Springfield, 34 miles, has been opened for business.

MOUNT HOOD RAILWAY & POWER COMPANY.—See Portland Eastern.

NEW ORLEANS GREAT NORTHERN.—On the line which this company is building from Slidell, La., north to Jackson, Miss., 150 miles, with branches to Tylertown, Miss., 44 miles, and to Abita Springs, La., 26 miles, track has been laid from Slidell north on the main line for 69 miles to Columbia Junction; also for 34 miles on the Tylertown branch, and nine miles on the Abita Springs branch. The company last year built 44 miles in Louisiana and 14 miles in Mississippi. Grading is in progress on the balance of the line.

NEW PARK & FAWN GROVE.—See Stewartstown.

OREGON SHORT LINE.—Work on the extension of the Yellowstone Park Railroad from St. Anthony, Idaho, to the Madison river entrance at the southwest corner of the park, 70 miles, is more than half finished, and it is intended to have the track laid this year on the entire line. There is a gap of about 15 miles yet to be built to reach the terminus at the Madison river. Through Rea's Pass the line has an elevation of 7,000 ft., and for a long stretch in the Warm River canyon, about 25 miles from St. Anthony, the work was very heavy. The cost of building this line will be about $1,500,000. (Mar. 15, p. 389.)

PACIFIC RAILWAY & NAVIGATION COMPANY.—Contracts, it is said, will soon be let by this company for building 10 miles of railroad from mile post 20 northeast of Tillamook, Ore. The work includes some heavy earth work, trestles and a tunnel. Contract for the tunnel has already been let. The Astoria branch has been located for about 60 miles. (May 3, p. 632.)

PORTLAND EASTERN.—Incorporated in Oregon with $5,000,000 capital by the promoters of the Mount Hood Railway & Power Company, organized to build a line to Mount Hood. The new company is to build a line from Portland, Ore., east to Clear lake at the base of Mount Hood by way of the Salmon river and through Frog Lake Pass in Wasco County, about 65 miles. The incorporators include: A. H. Fleming, of Los Angeles; E. B. Colwell, R. T. Linney and S. W. Miller.

PRESCOTT & NORTHWESTERN.—The Cheney branch from Helbig, Ark., to Cheney, 10 miles, and the Caddo & Choctaw branch from Rosoboro, Ark., to Spears, six miles, have been opened to business.

ST. LOUIS, BROWNSVILLE & MEXICO.—The main line of this road (Third division) has been extended from Bay City, Tex., northward to Algoa, 60 miles.

SHREVEPORT, ALEXANDRIA & SOUTHWESTERN SYSTEM.—An officer of the Louisiana & Pacific writes that this company has built a line from De Ridder toward Lake Charles to a crossing of the Colorado Southern, New Orleans & Pacific at Fulton, 26 miles from De Ridder. The proposed route is via Bon Ami and Longville to Lake Charles. The Lake Charles & Southern, which is a Southern Pacific project, is building a line from Lake Charles to Fulton, and will probably absorb the Louisiana & Pacific. Contracts for all the work from Lake Charles to De Ridder have been let. The work includes a bridge over the Calcasieu river.

SOUTHERN.—Work is reported under way, laying second track on sections of this road between Washington and Atlanta. About 200 miles of the 650 miles have been finished and a large amount of grading has been done on the remaining 450 miles.

SPOKANE INTERNATIONAL.—Passenger service between Spokane, Wash., and Eastport, Idaho, 141 miles, has been begun on this line, which is allied with the Canadian Pacific, giving that road entrance into Spokane.

STEWARTSTOWN.—An officer of the New Park & Fawn Grove writes that this company, which last year extended its road east to Fawn Grove in York County, Pa., will probably extend the line east seven miles this summer to Delta. No definite action has yet been taken. John H. Anderson, President, New York; S. M. Manifold, Chief Engineer, York, Pa.

TERRE HAUTE-MEROM TRACTION.—Incorporated in Indiana with $250,000 capital to build an electric line from Terre Haute south via Prairietown, Fairbanks and Staffordshire to Merom, 35 miles. The directors include: H. L. Marlett, F. S. Lewis, J. F. Roebuck, L. Brown, A. E. Hays, R. L. Ruby and V. Pounds.

UNION PACIFIC.—The Stromsburg branch of the Nebraska division has been extended from Hordville, Neb., west to Central City, 23 miles.

WATERLOO, PERLA & SOUTHWESTERN.—Surveys under way and rights of way being secured for this proposed line from Waterloo, Iowa, on the Chicago Great Western, and Chicago, Rock Island & Pacific, southwest via Traer, Tama, Grinnell, Pella and Knoxville to Chariton, on the Chicago, Burlington & Quincy, 125 miles. Contracts will probably be let in September. B. F. Keables, President; J. L. Blank, Chief Engineer, Pella.

WAYNESBURG & MONONGAHELA.—Incorporated in Pennsylvania with $84,000 capital to build a line from Waynesburg, Pa., northeast to Monongahela, 25 miles. J. L. Rose, President; W. P. Ely, W. A. Titus, E. L. Dewey and S. M. Scott, directors.

WICHITA FALLS & NORTHWESTERN.—The Wichita Falls & Northwestern Railway of Texas has been opened for business from Wichita Falls, Tex., to Burkburnett, 14 miles.

YELLOWSTONE PARK.—See Oregon Short Line.

YORK COUNTY TRACTION COMPANY.—Dodge & Day, Engineers and Constructors, Philadelphia, have begun work on an extension of the York, Pa., Street Railway from York southwest to Hanover, 20 miles. Rapid progress is being made with this extension.

RAILROAD CORPORATION NEWS.

ATLANTA, BIRMINGHAM & ATLANTIC.—This company has been given permission to issue $10,648,600 additional capital stock, making the total outstanding $35,000,000, of which $25,000,000 will be common and $10,000,000 preferred. There is now outstanding $16,170,700 common and $8,180,700 preferred stock. The proceeds from the sale of the new stock will be used to pay for construction now under way and for additional equipment. It is expected that the terminal now being built at Atlanta, Ga., will be finished by October 1, by which date the road is to be completed into Atlanta.

BOSTON & MAINE.—The Secretary of the Boston Merchants' Association says that at the conference of the committee of the association, the Chamber of Commerce and the Associated Board of Trade of Boston, President Mellen, of the New York, New Haven & Hartford, definitely and specifically made the following pledges:

"That his road would utilize to its fullest capacity the Commonwealth docks and other waterfront property controlled by it to the end of developing the foreign commerce of the city and port of Boston.

"That there should be no diminution in the freight and passenger facilities now provided by the New York, New Haven & Hartford and Boston & Maine systems in Boston, but that these facilities should be largely increased.

"That he would work for and felt that there could be secured the abolition of the existing differentials on freight destined for shipment abroad, and that he would work for the removal of all existing differentials on domestic freight, making the through rate between Boston and Western and Southern points no greater than those to and from New York, and had no doubt of his ability to produce that result.

"That under the proposed consolidation his road would make such changes in the terminal facilities of Boston as shall make the present south terminal a union station, from which all through trains shall start, retaining at the same time the present north station, with its facilities for traffic from the north side of the city, the purpose eventually being to construct tunnel connections between the two stations.

"That there shall be no advance in existing freight and passenger rates charged by either of these railroads without the consent of the Massachusetts Railroad Commissioners and the approval of the commercial organizations represented at this conference, and that he [President Mellen] will appear before the Massachusetts Legislature, if asked so to do, favoring a bill embodying these propositions."

Secretary Wolcott adds: "Mr. Mellen also stated during the conference that he would extend to the Canadian Pacific all of the facilities they now enjoy on the Boston & Maine system, and that his efforts would be directed toward increasing them as much as possible with the idea of developing the traffic both ways."

The principal opposition to the taking over of the Boston & Maine by the New York, New Haven & Hartford thus far has come from the Lawrence estate, which holds a large amount of Boston & Maine stock. A bill has been introduced in the interest of this estate, making it unlawful for the New York, New Haven & Hartford to control directly or indirectly or attempt to control the Boston & Maine, and directing it to dispose of its holdings. It forbids any official of the New Haven to act for the Boston & Maine, and prevents any company interested in the New Haven Company from controlling the Boston & Maine; forbids dividends on the Boston & Maine stock held in violation of the act; makes void any issue of New Haven stock in exchange for Boston & Maine, and gives the Supreme Court of Massachusetts jurisdiction to enforce its proposals. It is probable that President Mellen will appear at the legislative hearing on the consolidation.

The correspondence between President Mellen, of the New York, New Haven & Hartford, and Governor Guild, of Massachusetts, in regard to the acquisition for the New Haven of the Boston & Maine appears in full on page 861.

See New York, New Haven & Hartford.

Buffalo, Rochester & Pittsburg.—This company recently issued about $700,000 equipment trust bonds, series F. When the $35,000,000 consolidated mortgage, 4 per cent. bonds were authorized in April, $3,000,000 was made issuable to provide for construction under way or projected and equipment not otherwise provided for. (Apr. 26, p. 600.)

Chicago City Railway.—The dividend of this company has been reduced from 9 per cent. to 6 per cent. The reduction was made to bring the fixed charges of the company within the income which may be expected under the new franchise ordinance requiring a division of the net income with the city. The company paid 12 per cent. dividends from 1891 to 1901 and has since paid 9 per cent.

Detroit United.—See Lake Shore Electric.

Erie.—The Erie has sold $3,000,000 6 per cent., three year notes secured by $4,000,000 Erie & Jersey Railroad bonds. This is a low grade cut-off line from Highland Falls, north via Campbell Hall to Guymard, 40 miles, on which work was stopped not long ago, but has since been resumed, and is to be finished in 1908.

See Genesee River Railroad.

Genesee River Railroad.—This company has been authorized to issue $6,000,000 first mortgage bonds. The company, which is a subsidiary of the Erie, is building a line from Hunts, N. Y., to Cuba, 30 miles.

Great Northern.—Approximate gross earnings of the Great Northern for May were $5,639,541, an increase of $1,258,518 over the same month of 1906. For the 10 months ended May 31, gross earnings were $50,781,938, an increase of $3,196,079.

Joliet & Northern Indiana.—See Michigan Central.

Kanawha & Michigan.—The stockholders have authorized an issue of $2,500,000 second mortgage, 20-year, 5 per cent. bonds to pay off the floating debt. (May 24, p. 728.)

Lake Shore Electric.—It is reported that by an arrangement between this company and the Detroit United, through electric trains will soon be put in service between Cleveland and Detroit, 180 miles. The running time will be six hours. This is said to be the longest interurban limited run in the country.

Lehigh Valley.—See Lehigh Valley of New York.

Lehigh Valley of New York.—This company, which owns the Lehigh Valley's 281 miles of road in New York state, has been given permission to increase its capital stock from $11,200,000 to $13,543,000. The proceeds of the sale of the additional stock are to be used for improvements of terminals at Buffalo.

Michigan Central.—This company has sold to Moffat & White and Clark, Dodge & Co., New York, $1,500,000 4 per cent., 50 year, first mortgage bonds which are part of an authorized issue of $3,000,000 and are secured by a first mortgage on the Joliet & Northern Indiana, a belt line leased to the Michigan Central and running from Lake, Ind., to Joliet, Ill., 45 miles. The proceeds will be used to refund an issue of $800,000 Joliet & Northern Indiana 7 per cent. bonds guaranteed by the Michigan Central and to pay for elevating tracks in Joliet and other improvements.

Missouri, Oklahoma & Gulf.—It is reported that over $1,000,000 in bonds of this company has been bought by the French-American Bank of Paris. The road is already in operation from Wagoner, Ind. T., southwest through Muskogee to Dustin, 75 miles, with a two-mile branch. The company reports extensions under construction from Wagoner north to Joplin, Mo., 120 miles, and from Dustin south to Denison, Tex., 128 miles.

New York Central & Hudson River.—It is understood that in connection with the granting of trackage rights to the New Haven over certain Boston & Albany lines, the New Haven gave the New York Central an option on the controling interest which the New Haven holds in the capital stock of the New York, Ontario & Western.

New York Central Lines.—Gross earnings for May were as follows:

	1907.	Inc. or dec.	
New York Central & Hudson River	$8,418,605	Inc.	$1,168,364
Lake Shore & Michigan Southern	3,770,661	"	118,550
Lake Erie & Western	415,449	"	15,004
Chicago, Indiana & Southern	244,806	"	76,257
New York, Chicago & St. Louis	891,002	"	46,766
Michigan Central	2,371,460	"	272,374
Cleveland., Cincinnati, Chicago & St. Louis	2,292,469	"	302,806
Peoria & Eastern	253,431	"	15,856
Cincinnati Northern	86,263	Dec.	40
Pittsburg & Lake Erie	1,300,194	"	14,339
Rutland	272,169	Inc.	45,049
	$20,316,509	Inc.	$2,046,647

New York Connecting.—The State Railroad Commission has approved the increase of the capital stock of this road, which is to be built by the Pennsylvania to furnish a connection between its Long Island Railroad and the New York, New Haven & Hartford, from $1,000,000 to $3,000,000.

New York, New Haven & Hartford.—The New York, New Haven & Hartford has made an arrangement for trackage rights over several parts of the Boston & Albany and part of the Harlem division of the New York Central. These are as follows:

1. Boston to Ashland, 24 miles. Boston & Albany.
2. Pittsfield, Mass., to North Adams, 21 miles. Boston & Albany.
3. Boston Corners, N. Y., to Chatham, 28 miles. Harlem.
4. Springfield, Mass., to Albany, N. Y., 103 miles. Boston & Albany.

The first of these will connect two branches of the New York, New Haven & Hartford from Framingham north to Lowell and Fitchburg with Boston instead of having this traffic carried by the Boston & Albany between South Framingham and Boston as at present. It will also connect the branch line now connecting at Ashland directly with Boston, and will make possible closer and better connections from northern points over the Boston & Maine into Boston.

The Pittsfield-North Adams trackage will bring the New Haven line from the south now connecting at Pittsfield north to North Adams on the Fitchburg division of the Boston & Maine.

The Boston Corners-Chatham line will connect the Central New England with the Boston & Albany.

The most important of all of these is the 100-mile stretch of track from Albany to Springfield. This, besides connecting with the Central New England over line No. 3 just mentioned, will give the New York, New Haven & Hartford a new outlet for traffic from all its southern and eastern lines through the Albany gateway. By the acquisition of these trackage rights from the New York Central following so closely the purchase of the control of the Boston & Maine, the New Haven is given a very strong and efficient monopoly over New England traffic.

See Boston & Maine; also New York Central & Hudson River.

New York, Ontario & Western.—An annual dividend of 2 per cent. has been declared. This is the same amount which was paid in 1906. See New York Central & Hudson River.

Pennsylvania.—See New York, Connecting.

St. Louis, Brownsville & Mexico.—It is denied that this road has been bought in the interest of some of the Harriman railroads.

Southern Pacific.—With an increase of 213 miles operated, gross earnings for the month of April were $10,334,295 against $8,662,723. Expenses and taxes were $7,457,242 against $5,785,943. This increase resulted mostly from the continued congestion of traffic caused by the severe storms and washouts in March, which added largely to payments for overtime and also to the increase in the per diem rate and in station and yard forces due to congestion at the expense of a larger traffic together with a higher price of fuel and larger wage schedule. The increase in gross earnings after expenses and taxes was in each case a little over $1,671,000, so that net earnings after taxes were larger by only a nominal sum ($273) than in 1906. For the 10 months ended April 30, however, with 141 more average miles of road than in 1906, gross earnings were about $15,300,000; the expenses and taxes about $8,800,000, and net earnings after taxes about $6,500,000.

Tennessee & Carolina Southern.—This company, which is owned by the Southern, has given a trust deed to the Standard Trust Co. to secure an issue of $2,000,000 first mortgage 4 per cent. bonds due Jan. 1, 1957. The amount outstanding is $938,000. The proceeds from the bonds are being used in building an extension from Marysville, Tenn., toward Bushnell. Tracklaying has been begun.

Toledo Railway & Terminal Company.—The Ohio Savings Bank & Trust Company has filed a petition in the United States Circuit Court asking that the sale of the Toledo Railway & Terminal Company recently made at public auction for $2,000,000 to a committee representing the bondholders be vacated. It is charged that the road might have been sold for a larger price.

Trenton, Lakewood & Atlantic.—John M. Dickinson, of Trenton, has been appointed receiver of this company.

Virginia Railway.—An issue of $33,500,000 50-year, 5 per cent. mortgage bonds has been authorized. Of this amount $20,000,000 is to be issued at once to refund the debts of the Deepwater Railway and the Tidewater Railway, which have been merged in the above company. The remainder may be issued for new construction at the rate of $75,000 per mile of main line first track, and $50,000 per mile of branch line single track, or main line second track.